

IPC-2541

Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)



Endorsed by the National Electronics Manufacturing Initiative (NEMI)

IPC-2541

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A standard developed by IPC

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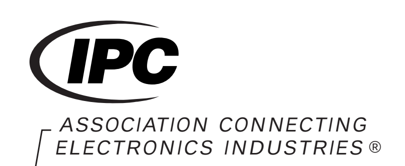
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IPC-2541



– GENERIC

Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)

A standard developed by the Generic Shop Floor XML Schema Formatting Task Group (2-13a) of the Shop Floor Communications Subcommittee (2-13) of IPC.

The IPC-2541 standard defines an XML encoding schema, which enables a detailed definition of electronics assembly, inspection, and test equipment messages to be encoded at a level appropriate to facilitate plug-and-play characteristics in a factory's shop-floor information system.

This project was initiated by the NEMI Plug-and-Play Factory Project which established proof of concept. After completion, the project leaders recommended standardization by IPC under the ANSI rules and procedures.



November 20, 2001

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Generic Shop Floor XML Schema Formatting Task Group (2-13a) of the Shop Floor Communications Subcommittee (2-13) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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GenRad Inc.

Generic Shop Floor XML Schema Formatting Task Group

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Bob Voitus, Celestica Inc.

Mark Williams, Motorola

A special note of thanks goes to the following individuals for their dedication to bringing this project to fruition. We would also like to highlight those individuals who were involved with the initial NEMI program concept and made major contributions to the development of the standard.

Allan Fraser, GenRad, Incorporated

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Mark Williams, Motorola

Andy Dugenske, Georgia Institute of Technology

David Kerem, Speedline Technologies

Bob Voitus, Celestica, Inc.

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Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)

Introduction

Factory Information Systems (FIS) form the nervous system of an enterprise, analysing data and delivering information to the machines and people who need to make information-based decisions. These systems provide a bi-directional flow of information between the factory floor and the rest of the enterprise. The National Electronics Manufacturing Initiative's (NEMI) Plug & Play Factory project addressed some critical problems involving factory information system deployment on the electronics manufacturing factory floor. The Plug & Play Factory project focused on the development of the standards necessary to achieve interoperability, or plug-and-play capability, on the factory floor. Activities were comprised of three areas:

- Definition of standards for a software framework that will allow interoperability between equipment produced by different vendors.
- Development of process-specific, machine communication interface standards for surface mount equipment. These standards will leverage the Generic Equipment Model (GEM) specification developed for semiconductor equipment and web-based standards for data transmission.
- Establishment of a test-bed manufacturing line to prove out the concepts developed by the project.

1 Scope

The IPC-2541 standard defines an XML encoding schema to facilitate plug-and-play characteristics in a factory's shop-floor information system. This standard describes the generic event message content, and should be used together with the IPC-2540 series sectional documents, which define the set of messages and key attributes of specific classes of equipment used in the electronics manufacturing area.

1.1 Interpretation

"Shall", the emphatic form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a **shall** requirement is not permitted, and compliance with the XML syntax and semantics shall be followed without ambiguity, or the insertion of superfluous information.

The words "should" and "may" are used whenever it is necessary to express non-mandatory provisions.

"Will" is used to express a declaration of purpose.

To assist the reader, the word **shall** is presented in bold characters.

2 Applicable documents

The following documents contain provisions that, through reference in this text, constitute provisions of this standard. All documents are subject to revision. Parties who make agreements

based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below.

IPC-T-50	Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC-2501	Generic Computer Aided Manufacturing (CAMX) Framework definitions
IPC-2511	Generic Computer Aided Manufacturing (GenCAM) descriptions for Printed Circuit Boards and Printed Board Assembly
IPC-2546	Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Assembly
IPC-2547	Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Test, Inspection and Rework

3 General Requirements

The requirements of IPC-2501 are a mandatory part of this standard. That document describes the generic requirements for the CAMX format.

3.1 Terms and Definitions

Downstream equipment
A piece of equipment located after another piece of equipment in a line.

Equipment Controller Down
The equipment cannot process instructions without operator or other personnel intervention.

Equipment Controller Up
When the equipment controller is running and the equipment Web client can send messages.

Equipment State
The various possible conditions of a piece of equipment. These include states such as ready, setup, down, and off.

Initialization
A normal directed process for the equipment to reach the state for its intended production function such as homing, calibration or initialization.

Item
An individual unit that is processed. An item usually consists of a single printed circuit board or a panelized board containing multiple circuits.

Item instance identifier
Item instance identifier is an identifier for an item. An item instance identifier may be derived from the serial number. If a bar code reader is present then the item instance identifier may be the bar code label that is read. If no bar code reader is present then the item instance identifier may be generated by the piece of equipment.

Lane
A lane is an independent processing path through a piece of equipment. A single piece of equipment may have multiple lanes.

Upstream equipment
A piece of equipment located before another piece of equipment in a line.

Zone
A staging area or a working area within a piece of equipment. A single piece of equipment may have many zones.

3.2 Date and Time Notation

All 2540 standards **shall** use the World Wide Web consortium (W3C) date time standard. This standard **shall** use the Complete Date plus Hours, Minutes, Seconds, and a decimal fraction of a second and Time Zone Designator. Two decimal places will be used in order to represent time down to a hundredth of a second. For additional information on date and time, see web page:

http://www.w3.org/TR/1998/NOTE-datetime-19980827

3.3 CAMX Compliance

All events defined in 2541 that are applicable to a piece of equipment **shall** be implemented in order to comply with this standard. The only exception to this rule is that for a single lane piece of equipment it is not required for the equipment to send the LaneStarved, LaneUnStarved, LaneBlocked, and LaneUnBlocked events. In addition, 2541 events can be extended in the 2540 series sectional documents. All of the attribute names defined in 2541 events must also be present in the events that are extended in the sectionals. All attribute names that are used to extend events defined in the sectionals must have different names than the attribute names defined in 2541. Individual equipment suppliers can also extend any events defined in the 2540 series of standards, providing they support all attribute names defined in the 2540 series of documents.

Equipment performance data will be included in specific event definitions that are defined or extended in each of the sectionals. The CAMX reporting mechanism will be different from how GEM reporting works today. Key reporting data will be defined in the 2540 sectionals that detail the information to be sent from the equipment when certain events occur on the equipment. For example, in the 2546 sectional, a placement machine pick error may be accompanied by the nozzle that performed the mis-pick, along with counts of previously successful picks by that nozzle, each time a component mis-pick event occurs on the equipment.

The IPC-2541 document defines a set of Equipment, Recipe, Item, and Operator events and related message formats. The IPC-2501 document defines a message packet structure. All shop floor equipment that complies with the IPC-2541 standards **shall** also comply with the event messages contained in the IPC-2501 standard as well as those events that are described in this document. All event messages **shall** be formatted in compliance with the IPC-2501. The following is a typical message example. The latest IPC-2501 requirements are available at http://webstds.ipc.org/2501.

```
<?xml version="1.0" " encoding = "UTF-8"?>
<!--Sample IPC2501/IPC2541 Message -->
<Envelope xmlns:xsi = "http://www.w3.org/2000/10/XMLSchema-instance"
    xsi:noNamespaceSchemaLocation = "http://webstds.ipc.org/2501/Envelope.xsd"
    xmlns:IPC2541 = "http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd"
    sender = "myhost.xyz.com/Line3/Machine1"
    messageID = "15.11.9.54.+2001-01-23T19:20:30.27+05:00"
    dateTime = "2001-01-23T19:20:30.27+05:00"
    messageSchema = "http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd"
```

```
    descriptionLanguage = "en"
    action = "PUBLISH">
        <Message>
                <IPC2541:EquipmentInitializationComplete
                dateTime = "2001-01-23T19:20:30.27+05:00"
                softwareRev = "Rev 3.2.0"
                hardwareRev = "Rev 7-B"/>
        </Message>
</Envelope>
```


4 Equipment State Model

The objective of the equipment state model is to capture important machine status information that can be used to track machine utilization and availability. It is useful in the monitoring and control of resources in automated surface mount (SMT) lines. A processing station in the SMT line processes raw materials to produce finished or semi-finished products, as shown below in Figure 1.

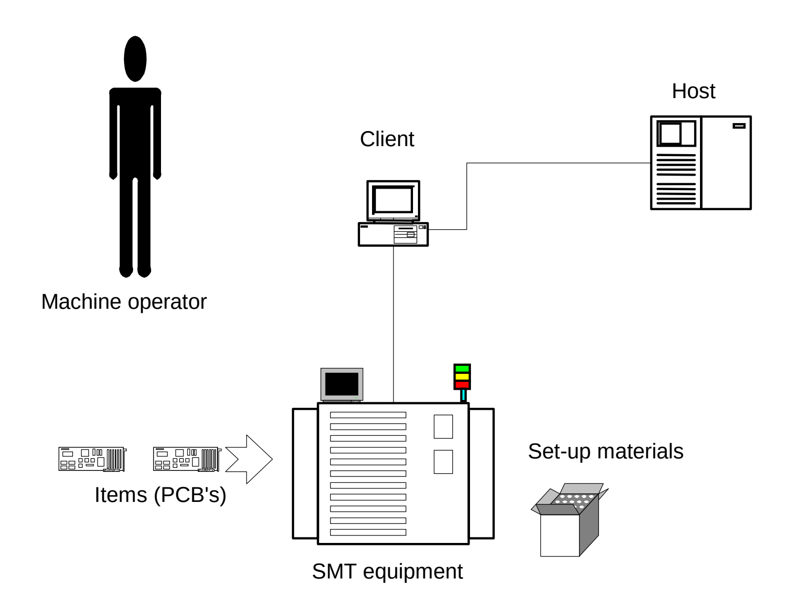


Figure 1 Elements Related to Equipment Monitoring and Control

The goals of the development of the CAMX equipment state model are the following:

1. Create an equipment state model and define states applicable to the electronics assembly, inspection, and test industry. This endeavor is analogous to that which resulted in the Semiconductor Equipment and Materials International (SEMI) E-10 standard for the semiconductor industry.
2. Minimize the number of states. Each state must have significance for process monitoring and control.
3. Define states so that no variations in the basic states are allowed in implementations.

The equipment model consists of three components: The state diagram, the state transition table and the events that trigger these state transitions. The state transitions are triggered by material

conditions, alarms, or operator or host inputs. In all cases the equipment **shall** send the appropriate message when the corresponding physical event occurs on the equipment.

The CAMX equipment state diagram is shown in Figure 2.

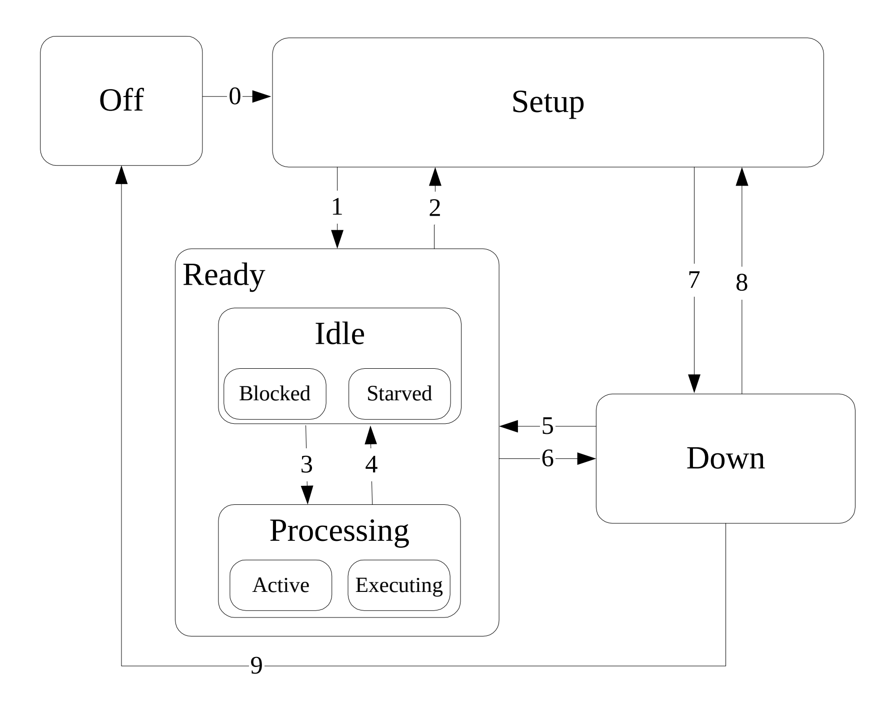


Figure 2 CAMX Equipment State Diagram

Some typical equipment state transitions are shown in Table 2. A complete listing of all of the event state transitions is shown in Table 3.

Table 2 Example State Transition Table for Equipment State Model

Arrow	Current state	Typical trigger	Specific example	New state
0	OFF	Power On (Default entry)	EquipmentInitializationComplete	SETUP
1	SETUP	Complete Setup	EquipmentSetupComplete	Any READY sub-state or DOWN
2	READY	Start Setup	EquipmentSetupSelected	SETUP
3	READY-IDLE-STARVED	Material Received	EquipmentUnStarved	READY-PROCESSING-ACTIVE
4	READY-PROCESSING-ACTIVE	Material Output Blocked	EquipmentBlocked	READY-IDLE-BLOCKED
5	DOWN	Press "Start"	EquipmentStartSelected	Any READY sub-state
6	READY	Out of Supply	EquipmentAlarm	DOWN
7	SETUP	Major Error	EquipmentError	DOWN
8	DOWN	Start Setup	EquipmentSetupSelected	SETUP
9	DOWN	Controlled Shutdown	EquipmentPowerOff	OFF

Each piece of equipment must track its own state. Each state is mutually exclusive. Each event can cause the equipment to enter one and only one new state. At any point in time, the state of a piece of equipment is uniquely determined by the most recent event that occurred on the equipment.

The terms used to refer to the various equipment states are defined as follows:

IDLE means a piece of equipment is ready to process items but is not doing so. The piece of equipment may be in either the STARVED or BLOCKED sub-states.

STARVED is a sub-state of IDLE. This is the state of a piece of equipment when it is ready to receive an item from an upstream piece of equipment but no item is available. The equipment's working area is available to work but it is not being given anything to build. There is no unfinished work within the equipment and there are no items available to move into the equipment. The equipment is empty and it can't pull any items in to work on.

BLOCKED is a sub-state of IDLE. This is the state of a piece of equipment when it is ready to send completed items to a downstream piece of equipment but it is prevented from doing so by the downstream piece of equipment. Processing of all items in a working zone within the equipment has been completed. The equipment is unable to accept any new items into its staging or working zones. The equipment is full and it can't push any items out.

PROCESSING means that a piece of equipment is productively working on an item. The piece of equipment may be in either the ACTIVE or EXECUTING sub-states.

EXECUTING is the sub-state of PROCESSING in which the equipment is executing a recipe and it can continue to do so without external intervention. The executing sub-state includes times like fiducial finding and board alignment for a piece of placement equipment.

ACTIVE is the sub-state of PROCESSING when an item is available but no recipe is being executed. This includes time intervals when items are transferring into a piece of equipment, out of a piece of equipment, or between different zones within a piece of equipment.

READY is a superset of the PROCESSING and IDLE states.

SETUP means that a piece of equipment is being configured. Set-up involves a deliberate action being taken on the equipment.

DOWN means that a piece of equipment can not produce items either due to a lack of components or other consumable material, an equipment malfunction, host or operator intervention,or equipment initiated events. A piece of equipment that is in the DOWN state is not in the SETUP, READY, or OFF states.

OFF means that a piece of equipment has been powered down and is not available for production.

Table 3 Complete State Transition Table for Equipment State Model

EVENT NAME	SEE PARA	TYPICAL TRIGGER	CURRENT STATE	NEXT STATE
EquipmentAlarm	7.6.12	Unsafe condition for operator or machine has occurred.	Any	DOWN
EquipmentAlarmCleared	7.6.13	Alarm condition has been removed.	DOWN	DOWN
EquipmentAlarmsCleared	7.6.14	All alarm conditions have been removed.	DOWN	DOWN
EquipmentBlocked	7.5.3	Item work is complete but output queue is not available.	READY-PROCESSING-ACTIVE	READY-IDLE-BLOCKED
EquipmentChangeState	7.2.1	An event caused an equipment State Change	Any	Any Other
EquipmentDownSelected	7.6.5	The operator or host has selected the equipment down mode.	Any Other	DOWN
EquipmentError	7.6.15	Trapped equipment error.	Any	DOWN
EquipmentErrorCleared	7.6.16	Operator or other interaction has removed the error condition.	DOWN	DOWN
EquipmentErrorsCleared	7.6.17	All error conditions have been removed.	DOWN	DOWN
EquipmentHeartbeat	7.1.1	Equipment sends a keep alive message.	Any	Same
EquipmentInformation	7.6.21	Informational message emitted.	Any	Same
EquipmentInitializationComplete	7.6.1	Boot process has completed and the equipment is ready for recipe and material.	OFF	SETUP
EquipmentNonSelectedRecipe-Modified	7.6.10	A non-selected recipe has been modified by the operator or host computer	Any	Same

EVENT NAME	SEE PARA	TYPICAL TRIGGER	CURRENT STATE	NEXT STATE
EquipmentParameterModified	7.6.11	Equipment parameter has been changed, either by the operator or by the host.	Any	Same
EquipmentPowerOff	7.6.6	Equipment is being powered down via a controlled shutdown procedure.	DOWN	OFF
EquipmentRecipeReady	7.6.8	The recipe file is loaded.	Any	Same
EquipmentRecipeSelected	7.6.7	Recipe file has been selected	Any	Same
EquipmentSelectedRecipe-Modified	7.6.9	Selected recipe has been modified by the operator or host computer.	Any	Same
EquipmentSetupComplete	7.6.2	Equipment has completed setup.	SETUP	Any READY sub-state or DOWN
EquipmentSetupSelected	7.6.4	The operator or host has selected the equipment setup mode.	Any Other	SETUP
EquipmentStartSelected	7.6.3	The equipment itself, an operator, or host has selected the equipment start mode.	Any Other	Any READY sub-state
EquipmentStarved	7.5.1	Equipment is ready but there is no product item available.	Any Other	READY-IDLE-STARVED
EquipmentUnBlocked	7.5.4	Equipment has been blocked and output queue becomes available.	READY-IDLE-BLOCKED	READY-PROCESSING-ACTIVE
EquipmentUnStarved	7.5.2	Equipment has been starved and now there is new product available.	READY-IDLE-STARVED	READY-PROCESSING-ACTIVE
EquipmentWarning	7.6.18	Warning message emitted	Any	Same
EquipmentWarningCleared	7.6.19	Warning condition cleared	Any	Same
EquipmentWarningsCleared	7.6.20	All warning conditions cleared	Any	Same
ItemIdentifierRead	7.3.10	An item is available and its Identification label has been read successfully.	READY-PROCESSING-ACTIVE	Same
ItemInformation	7.3.11	Non-threatening item information is emitted.	Any	Same
ItemTransferIn	7.3.6	An item has entered the equipment.	Any	Same
ItemTransferLane	7.3.9	An item has transferred from one equipment lane to another.	Any	Same
ItemTransferOut	7.3.7	An item has transferred out of the equipment.	Any	Same
ItemTransferZone	7.3.8	An item has transferred from one equipment zone to another.	Any	Same
ItemWorkAbort	7.3.4	Process work that has been paused on an item is aborted.	READY-PROCESSING-ACTIVE	Same
ItemWorkComplete	7.3.5	Process work on an item is complete.	READY-PROCESSING-EXECUTING	READY-PROCESSING-ACTIVE

EVENT NAME	SEE PARA	TYPICAL TRIGGER	CURRENT STATE	NEXT STATE
ItemWorkPause	7.3.2	Process execution on an item has been paused.	READY-PROCESSING-EXECUTING	READY-PROCESSING-ACTIVE
ItemWorkResume	7.3.3	Process work on an item has been restarted.	READY-PROCESSING-ACTIVE	READY-PROCESSING-EXECUTING
ItemWorkStart	7.3.1	The equipment begins executing its process on a product item.	Any READY Sub-state	READY-PROCESSING-EXECUTING
LaneBlocked	7.4.3	Item work is complete but output queue is not available for that lane.	Any	Same
LaneStarved	7.4.1	Equipment lane is ready but there is no item to process.	Any	Same
LaneUnBlocked	7.4.4	Equipment lane has been blocked and output queue becomes available	Any	Same
LaneUnStarved	7.4.2	Equipment lane has been starved and now there is a new item available to process.	Any	Same
OperatorActionRegistered	7.7.2	An operator intervention has taken place.	Any	Same
OperatorInformation	7.7.1	Operator instigated information message is emitted.	Any	Same
WaitingForOperatorAction	7.7.3	The process is halted for a reason other than a starved or blocked piece of equipment and human intervention is required before processing can resume.	Any	Down

5 Multiple Zone and Multiple Lane Equipment State Prioritization

In order to give further clarification to the state of a piece of equipment containing multiple lanes or zones the following rule will be used. When any of the lanes of a piece of equipment, or any of the zones within a lane, is in one of the following states, the equipment will assume the state of the lane or the zone that has the highest priority according to the priorities shown in Table 4.

Table 4 – Prioritization of Multiple Lane/Multiple Working Zone Equipment States

PRIORITY (1= Highest)	STATE
1	READY-PROCESSING-EXECUTING
2	READY-PROCESSING-ACTIVE
3	READY-IDLE-STARVED
4	READY-IDLE-BLOCKED
5	SETUP
6	DOWN
7	OFF

6 Equipment Alarm, Error, Warning, and Information Messages

Equipment alarms are events which are sent when dangerous conditions occur that can cause danger to either people or equipment if not addressed immediately.

Equipment errors are events which cause the equipment to malfunction and not operate correctly.

Equipment warnings are events which do not cause any immediate problems. Equipment warnings may escalate into either equipment error conditions or equipment alarm conditions if not addressed.

Equipment information messages are generated by the equipment when an interesting event occurs on the equipment.

The difference between equipment warnings and equipment error messages is that warnings do not change the state of the machine, whereas equipment errors do change the state of the machine.

The difference between equipment warnings and equipment information messages is that equipment warnings do need to be cleared whereas equipment information messages do not need to be cleared.

Table 5 illustrates the differences between Equipment Alarm, Error, Warning, and Information messages.

EquipmentAlarm, EquipmentError, and EquipmentWarning events must maintained when the equipment is powered down and back up again.

If a piece of equipment determines that it cannot communicate then it must be able to spool all events locally.

Table 5 – Equipment Alarms, Errors, Warning, and Information Events Characteristics

	Tracked by Equipment	Cleared by Equipment or Host	State Change	Dangerous Condition
Alarms	Y	Y	Y	Y
Errors	Y	Y	Y	N
Warnings	Y	Y	N	N
Information	N	N	N	N

7 Event Extensions

All 2541, 2546, and 2547 messages can be extended. An element called Extensions will be included in each event. See the 2541 XML Schema section for a complete listing of the XML schema used in the 2541 standard. The following sections show the name for each event, along with any state changes associated with the event, the description of the event, all attributes and their type for each event, as well as an illustrative example of how that event could be used in an actual production situation. The right-most column indicates the expected number of occurrences (cardinality) of each attribute or element. In this standard all attributes or elements are mandatory as is indicated by 1-1. The IPC-2546 and IPC-2547 use 0-1 to indicate an optional field. 1-1 to indicate a single mandatory field. 0-n to indicate any number, including zero. 1-n indicates at least one.

7.1 Equipment Heart Beat Event

7.1.1 Event: EquipmentHeartbeat

StateChange: This event does not cause any state changes.

Description: This event sends a heart beat at a regular time interval from a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
Interval	Non-negative integer	Time interval between heart beat events being sent by the piece of equipment. A value of 0 means that the equipment will send no further heart beat events.	1-n

```
<EquipmentHeartbeat
  dateTime="2000-02-02T10:33:00.00-05:00"
  interval=60
/>
```

7.2 Equipment State Change Event

7.2.1 Event: EquipmentChangeState

StateChange: This event reports a state change, it does not cause any state changes.

Description: This event occurs only when a piece of equipment changes state. This event uniquely identifies the event that caused the equipment to change state. Even though there may be many events occurring at the same time on a piece of equipment, the event identifier listed here is the name of the event that caused the equipment to change state.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
currentState	string (enumerated)	READY-IDLE-BLOCKED | READY-IDLE-STARVED | READY-PROCESSING-ACTIVE | READY-PROCESSING-EXECUTING | SETUP | OFF DOWN	1-1
previousState	string (enumerated)	READY-IDLE-BLOCKED | READY-IDLE-STARVED | READY-PROCESSING-ACTIVE | READY-PROCESSING-EXECUTING | SETUP | OFF DOWN	1-1
eventId	string	Event identifier which caused the state change	1-1

```
<EquipmentChangeState
  dateTime="2000-02-02T10:35:00.00-05:00"
  currentState="READY-PROCESSING-ACTIVE"
  previousState="READY-IDLE-STARVED"
  eventId="EquipmentUnStarved"
/>
```

7.3 Item Events

7.3.1 Event: ItemWorkStart

StateChange: Any READY Sub-state

Description: This event occurs when an item is starting to be worked on by a piece of equipment. This event must be the first processing event for a specific item. This event must be sent for every individual working zone. The ItemWorkComplete, ItemWorkAbort, or ItemWorkPause events may follow this event.

Attribute Name	Attribute Type	Description	Occ.
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane number	1-n
zoneId	string	Area segment number	1-n

```
<ItemWorkStart
  dateTime="2000-02-02T10:35:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
  zoneId="2"
/>
```

7.3.2 Event: ItemWorkPause

StateChange: Ready-Processing-Executing->Ready-Processing-Active

Description: This event occurs when an item is paused. A pause may be caused either by the equipment itself, by an operator, or by a host computer. Either an ItemWorkResume event or an ItemWorkAbort event must follow this event.

Attribute Name	Attribute Type	Description	Occ.
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n
zoneId	string	Area segment identifier	1-n
pauseId	string	Pause identifier	1-1

```
<ItemWorkPause
  dateTime="2000-02-02T10:37:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
  zoneId="2"
  pauseId="Paused waiting for parts"
/>
```

7.3.3 Event: ItemWorkResume

StateChange: Ready-Processing-Active->Ready-Processing-Executing

Description: This event occurs when work on an item is resumed. This event may be triggered either by an operator or by a host computer.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n
zoneId	string	Area segment identifier	1-n

```
<ItemWorkResume
  dateTime="2000-02-02T10:39:12.00-05:00"
  itemInstanceId="001"
  laneId="Left"
  zoneId="Curing"
/>
```

7.3.4 Event: ItemWorkAbort

StateChange: No state change.

Description: This event occurs when work on an item is aborted.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n
zoneId	string	Area segment identifier	1-n
abortId	string	Abort identifier	1-1

```
<ItemWorkAbort
  dateTime="2000-02-02T10:41:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
  zoneId="2"
  abortId="Aborted due to bad material"
/>
```

7.3.5 Event: ItemWorkComplete

StateChange: Ready-Processing-Executing->Ready-Processing-Active

Description: This event indicates the completion of the processing of an item. This event must be sent for every individual working zone. This event does not indicate anything about the quality of the processing, it is merely indicating that the processing of that item is complete. This event must be preceded by an ItemWorkStart message.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n
zoneId	string	Area segment identifier	1-n

```
<ItemWorkComplete
  dateTime="2000-02-02T10:43:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
  zoneId="2"
/>
```

7.3.6 Event: ItemTransferIn

StateChange: No State Change

Description: The item has finished transferring into the first zone of a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n

```
<ItemTransferIn
  dateTime="2000-02-02T10:45:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
/>
```

7.3.7 Event: ItemTransferOut

StateChange: No State Change

Description: The item has finished transferring out of the last zone of a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n

```
<ItemTransferOut
  dateTime="2000-02-02T10:47:12.00-05:00"
  itemInstanceId="001"
  laneId="1"
/>
```

7.3.8 Event: ItemTransferZone

StateChange: No State Change

Description: The equipment sends this event when an item has finished transferring between any two zones within a piece of equipment. This event must not be sent when an item enters the first zone of a piece of equipment nor when it leaves the last zone of a piece of equipment. See the ItemTransferIn and ItemTransferOut events for these two cases. The first zone inside a machine must have a Zone identifier of 1.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
fromZoneId	string	From area segment identifier	1-n
toZoneId	string	To area segment identifier	1-n
laneId	string	Line lane identifier	1-n

```
<ItemTransferZone
  dateTime="2000-02-02T10:49:12.00-05:00"
  itemInstanceId="001"
  fromZoneId="2"
  toZoneId="3"
  laneId="1"
/>
```

7.3.9 Event: ItemTransferLane

StateChange: No State Change

Description: The equipment sends this event when an item has finished transferring between any two lanes within a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
fromLaneId	string	From lane segment identifier	1-n
toLaneId	string	To lane segment identifier	1-n
zoneId	string	Equipment zone identifier	1-n

```
<ItemTransferLane
  dateTime="2000-02-02T10:51:12.00-05:00"
  itemInstanceId="001"
  fromLaneId="2"
  toLaneId="3"
  zoneId="1"
/>
```

7.3.10 Event: ItemIdentifierRead

StateChange: No State Change

Description: This event is sent when an item's label containing an identifier has been read by a piece of equipment (e.g., barcode label, RF tag). If the equipment has label readers on the top and bottom side of one lane, the scannerId must contain the location of the label readers.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Item instance identifier	1-1
laneId	string	Line lane identifier	1-n
zoneId	string	Zone identifier	1-n
scannerId	string	Unique scanner identifier	1-1

```
<ItemIdentifierRead
  dateTime="2000-02-02T10:53:12.00-05:00"
  itemInstanceId="001"
  laneId="2"
  zoneId="2"
  scannerId="Input Conveyor, Placer 1-IC"
/>
```

7.3.11 Event: ItemInformation

StateChange: No State Change

Description: Item information messages that are directly related to the assembly process, and are not associated with a specific machine subsystem. These indicate a no problem condition without a recovery screen.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Current date and time	1-1
itemInstanceId	string	Serial number, Product type, Lot Id	1-1
informationId	string	Information identifier	1-1

```
<ItemInformation
  dateTime="2000-02-02T10:55:12.00-05:00"
  itemInstanceId="001"
  informationId="EquipmentMessage56"
/>
```

7.4 Lane Flow Events

Lane flow events are used to track the events occurring on an individual lane of a multi-lane piece of equipment. The state of the equipment is determined solely by the equipment flow events as shown in Table 4 "Prioritization of Multiple Lane and Multiple Working Zone Equipment States**".** For a single lane piece of equipment it is not required for the equipment to send the LaneStarved, LaneUnStarved, LaneBlocked, and LaneUnBlocked events.

7.4.1 Event: LaneStarved

StateChange: No State Change

Description: This event is triggered when a lane is ready to receive an item from an upstream piece of equipment but no item is available. All zones in the lane are empty. There is no unfinished work within the lane and there are no items available to move into the lane. All zones in the lane are empty and it can't pull any items in to work on.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
laneId	string	Line lane identifier	1-n

```
<LaneStarved
  dateTime="2000-02-02T10:57:12.00-05:00"
  laneId="001"
/>
```

7.4.2 Event: LaneUnStarved

StateChange: No State Change

Description: This event denotes the removal of a LaneStarved condition. This event may only be sent after a LaneStarved event. This means that an item is available for the equipment to work on.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
laneId	string	Line lane identifier	1-n

```
<LaneUnStarved
  dateTime="2000-02-02T10:59:12.00-05:00"
  laneId="001"
/>
```

7.4.3 Event: LaneBlocked

StateChange: No State Change

Description: The event is triggered when a lane is ready to send completed items to a downstream piece of equipment but is prevented from doing so by the downstream piece of equipment. Processing of all items in all working zones within the lane has been completed. There is no room available within any of the equipment's zones. The lane is unable to accept any new items into its staging or working zones. The lane is full and it can't push any items out.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
laneId	string	Line lane identifier	1-n

```
<LaneBlocked
  dateTime="2000-02-02T11:01:12.00-05:00"
  laneId="001"
/>
```

7.4.4 Event: LaneUnBlocked

StateChange: No State Change

Description: This event denotes the removal of a LaneBlocked condition. This event may only be sent after a LaneBlocked event. This means that an item can be transferred out of a lane. The downstream equipment blockage has been removed.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
laneId	string	Line lane identifier	1-n

```
<LaneUnBlocked
  dateTime="2000-02-02T11:03:12.00-05:00"
  laneId="001"
/>
```

7.5 Equipment Flow Events

7.5.1 Event: EquipmentStarved

StateChange: Current State -> READY-IDLE-STARVED

Description: This event is triggered when a piece of equipment is ready to receive an item from an upstream piece of equipment but no item is available. The equipment's working area is available to work but it is not being given anything to build. There is no unfinished work within the piece of equipment and there are no items available to move into the equipment. The equipment is empty and it can't pull any items in to work on.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentStarved
  dateTime="2000-02-02T11:05:12.00-05:00"
/>
```

7.5.2 Event: EquipmentUnStarved

StateChange: Ready-Idle-Starved -> READY-PROCESSING-ACTIVE

Description: This event denotes the removal of an EquipmentStarved condition. This event may only be sent after an EquipmentStarved event. This means that an item is available for the equipment to work on.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentUnStarved
  dateTime="2000-02-02T11:07:12.00-05:00"
/>
```

7.5.3 Event: EquipmentBlocked

StateChange: Current State -> READY-IDLE-BLOCKED

Description: The event is triggered when a piece of equipment is ready to send completed items to a downstream piece of equipment but is prevented from doing so by the downstream piece of equipment. Processing of all items in a working zone within the equipment has been completed. The equipment is unable to accept any new items into its staging or working zones. The equipment is full and it can't push any items out.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentBlocked
  dateTime="2000-02-02T11:09:12.00-05:00"
/>
```

7.5.4 Event: EquipmentUnBlocked

StateChange: READY-IDLE-BLOCKED - /> READY-PROCESSING-ACTIVE

Description: This event denotes the removal of an EquipmentBlocked condition. This event may only be sent after an EquipmentBlocked event. This means that an item can be transferred out of a piece of equipment. The downstream equipment blockage has been removed.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentUnBlocked
  dateTime="2000-02-02T11:11:12.00-05:00"
/>
```

7.6 Equipment Events

7.6.1 Event: **EquipmentInitializationComplete**

StateChange: Off -> SETUP

Description: This event is sent when power is applied to the piece of equipment and the piece of equipment has entered the Setup state.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
softwareRev	string	Software or Firmware revision code	1-1
hardwareRev	string	Hardware revision code	1-1

```
<EquipmentInitializationComplete
  dateTime="2000-02-02T11:13:12.00-05:00"
  softwareRev="Rev 3.2.0"
  hardwareRev="Rev 7-B"
/>
```

7.6.2 Event: EquipmentSetupComplete

StateChange: SETUP -> Any READY Sub-state or DOWN

Description: This event is sent when setup is complete and the equipment is ready to process items.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentSetupComplete
  dateTime="2000-02-02T11:12:12.00-05:00"
/>
```

7.6.3 Event: EquipmentStartSelected

StateChange: Current State -> Any READY Sub-state

Description: This event is sent when Setup is complete and the equipment has entered the Ready state. Either the equipment itself, an operator, or a host computer can initiate the transition into the any READY sub-state. The eventInitiator attribute may have the default value of "Operator" if tracking of personal data is not possible.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
eventInitiator	string	Identifier of person or host who initiated event	1-1

```
<EquipmentStartSelected
  dateTime="2000-02-02T11:15:12.00-05:00"
  eventInitiator="Operator 10650"
/>
```

7.6.4 Event: EquipmentSetupSelected

StateChange: Current State -> SETUP

Description: This event is sent when the equipment has completed its transition into the SETUP state. This event typically occurs in response to an equipment operator or host computer-initiated command.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
eventInitiator	string	Identifier of person or host who initiated event	1-1

```
<EquipmentSetupSelected
  dateTime="2000-02-02T11:17:12.00-05:00"
  eventInitiator="SMT Line 2 Host"
/>
```

7.6.5 Event: EquipmentDownSelected

StateChange: Current State -> DOWN

Description: This event is sent when the equipment has completed its transition into the DOWN state. This event typically occurs in response to an equipment operator or host computer-initiated command.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
eventInitiator	string	Identifier of person or host who initiated event	1-1

```
<EquipmentDownSelected
  dateTime="2000-02-02T11:21:12.00-05:00"
  eventInitiator="SMT Line 2 Host"
/>
```

7.6.6 Event: EquipmentPowerOff

StateChange: DOWN -> OFF

Description: This event is sent when the equipment is powered down during a controlled shutdown procedure. This event is not sent during an emergency shutdown.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
eventInitiator	string	Identifier of person or host who initiated event	1-1

```
<EquipmentPowerOff
  dateTime="2000-02-02T11:22:12.00-05:00"
  eventInitiator="Joe Smith"
/>
```

7.6.7 Event: EquipmentRecipeSelected

StateChange: No State Change

Description: This event is sent when a recipe is selected for use on a piece of equipment. A recipe must be selected before it can become the active recipe for a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
recipeId	string	Identifier of the new program	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentRecipeSelected
  dateTime="2000-02-02T11:23:12.00-05:00"
  recipeId="12345.A"
  laneList="1-3,4,5"
  zoneList="1"
/>
```

7.6.8 Event: EquipmentRecipeReady

StateChange: No state change

Description: This event is sent when a recipe is ready to run on a piece of equipment. The selected recipe has become the active recipe for the piece of equipment. This event must be sent after an EquipmentRecipeSelected event.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
recipeId	string	Identifier of the new program	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentRecipeReady
  dateTime="2000-02-02T11:25:12.00-05:00"
  recipeId="12345.B"
  laneList="1-3,4,5"
  zoneList="1-7"
/>
```

7.6.9 Event: EquipmentSelectedRecipeModified

StateChange: No State Change

Description: This event is sent whenever a selected recipe on a piece of equipment has been modified. This event occurs whenever a selected recipe has been edited and saved.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
recipeId	string	Identifier of the modified program	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 and 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4, and 5)	1-n, 1-m
action	string (enumerated)	DELETE|MODIFY	1-1

```
<EquipmentSelectedRecipeModified
  dateTime="2000-02-02T11:27:12.00-05:00"
  recipeId="12345 Rev C"
  laneList="1-3,5"
  zoneList="1"
  action="MODIFY"
/>
```

7.6.10 Event: EquipmentNonSelectedRecipeModified

StateChange: No State Change

Description: This event is sent whenever a non-selected recipe on a piece of equipment has been modified. This event occurs whenever an existing recipe has been edited and saved.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
recipeId	string	Identifier of the modified program	1-1
action	string (enumerated)	CREATE|DELETE|MODIFY	1-1

```
<EquipmentNonSelectedRecipeModified
  dateTime="2000-02-02T11:29:12.00-05:00"
  recipeId="Product A Top Side Line 1"
  action="CREATE"
/>
```

7.6.11 Event: EquipmentParameterModified

StateChange: No State Change

Description: This event is sent whenever a parameter on a piece of equipment has been modified. This event occurs whenever an existing equipment parameter has been edited and saved.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
parameter	string	Identifier of the modified parameter or group of parameters.	1-1

```
<EquipmentParameterModified
  dateTime="2000-02-02T11:31:12.00-05:00"
  parameter="Vision System"
/>
```

7.6.12 Event: EquipmentAlarm

StateChange: Current State -> DOWN

Description: This event is sent whenever an alarm condition is encountered on a piece of equipment. An alarm indicates a dangerous situation for people, equipment, or items. Alarms are distinguished from errors in that they must be acted on immediately.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
alarmId	string	Alarm identifier	1-1
alarmInstanceId	string	Specific alarm instance identifier	1-1
alarmType	string (enumerated)	PERSONALSAFETY | EQUIPMENTSAFETY | ITEMSAFETY| PARAMETERCONTROLALARM	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentAlarm
  dateTime="2000-02-02T11:33:22.00-05:00"
  alarmId="MotorOilLow"
  alarmInstanceId="30465"
  alarmType="EQUIPMENTSAFETY"
  laneList="1,2"
  zoneList="3"
/>
```

7.6.13 Event: EquipmentAlarmCleared

StateChange: No State Change

Description: This event is sent when an individual alarm is cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
alarmInstanceId	string	Specific alarm instance identifier	1-1

```
<EquipmentAlarmCleared
  dateTime="2000-02-02T11:35:22.00-05:00"
  alarmInstanceId="30465"
/>
```

7.6.14 Event: EquipmentAlarmsCleared

StateChange: No State Change

Description: This event is sent when all alarm conditions have been cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentAlarmsCleared
  dateTime="2000-02-02T11:37:22.00-05:00"
/>
```

7.6.15 Event: EquipmentError

StateChange: Current State -> DOWN

Description: This event is sent by a piece of equipment when a piece of equipment encounters a situation where it can no longer process an item. The equipment requires either operator or host assistance to remedy the error situation.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
errorId	string	Error identifier	1-1
errorInstanceId	string	Specific error instance identifier	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentError
  dateTime="2000-02-02T11:39:22.00-05:00"
  errorId="45"
  errorInstanceId="321-001"
  laneList="1"
  zoneList="1-3,5"
/>
```

7.6.16 Event: EquipmentErrorCleared

StateChange: No State Change

Description: This event is sent when an individual error condition has been cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
errorInstanceId	string	Specific error instance identifier	1-1

```
<EquipmentErrorCleared
  dateTime="2000-02-02T11:41:22.00-05:00"
  errorInstanceId="321-001"
/>
```

7.6.17 Event: EquipmentErrorsCleared

StateChange: No State Change

Description: This event is sent whenever all error conditions have been cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1

```
<EquipmentErrorsCleared
  dateTime="2000-02-02T11:43:22.00-05:00"
/>
```

7.6.18 Event: EquipmentWarning

StateChange: No State Change

Description: This event is sent by a piece of equipment when a piece of equipment encounters a situation that does not cause an error but will cause problems if not attended to in a timely manner. An example of a warning would be an event, which if not addressed, would degrade the performance of the equipment. The equipment will not stop and it will continue to process items.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
warningId	string	Warning identifier	1-1
warningInstanceId	string	Specific warning instance identifier	1-1
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentWarning
  dateTime="2000-02-02T11:45:22.00-05:00"
  warningId="PreventiveMaintenanceRequired–Change Oil Filter"
  warningInstanceId="1828494"
  laneList="1"
  zoneList="1-3"
/>
```

7.6.19 Event: EquipmentWarningCleared

StateChange: No State Change

Description: This event is sent when an individual warning condition has been cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
warningInstanceId	string	Specific warning instance identifier	1-1

```
<EquipmentWarningCleared
  dateTime="2000-02-02T11:47:22.00-05:00"
  warningInstanceId="1828494"
/>
```

7.6.20 Event: EquipmentWarningsCleared

StateChange: No State Change

Description: This event is sent when all warning conditions have been cleared on a piece of equipment.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
warningInstanceId	string	Specific warning instance identifier	1-1

```
<EquipmentWarningsCleared
  dateTime="2000-02-02T11:49:22.00-05:00"
/>
```

7.6.21 Event: EquipmentInformation

StateChange: No State Change

Description: This event is sent by a piece of equipment when an interesting event occurs on the equipment. This event will not result in either an error or a warning. EquipmentInformation events are different from EquipmentWarning events because they are not tracked on an individual basis nor do they need to be cleared. No direct operator or host action is required.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
informationId	string	Information identifier	
laneList	stringList	List of affected lanes (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m
zoneList	stringList	List of affected zones (eg: 1,3-5 means 1,3,4 & 5)	1-n, 1-m

```
<EquipmentInformation
  dateTime="2000-02-02T11:51:22.00-05:00"
  informationId="All systems operating normally"
  laneList="1"
  zoneList="1-5"
/>
```

7.7 Operator Information Events

7.7.1 Event: OperatorInformation

StateChange: No State Change

Description: Operator information messages are generated as the result of an operator action. These indicate a no problem condition and so do not require recovery mechanism.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
operatorId	string	Operator identifier	1-1
informationId	string	Information identifier	1-1

```
<OperatorInformation
  dateTime="2000-02-02T11:53:22.00-05:00"
  operatorId="Operator 1"
  informationId="New tooling working fine"
/>
```

7.7.2 Event: OperatorActionRegistered

StateChange: No State Change

Description: The equipment is indicating that an operator action has been performed**.**

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
operatorId	string	Operator identifier	
description	string	Description of operator action	

```
<OperatorActionRegistered
  dateTime="2000-02-02T11:55:22.00-05:00"
  operatorId="Operator 1"
  description="Machine Calibration Complete"
/>
```

7.7.3 Event: WaitingforOperatorAction

StateChange: Current State -> DOWN

Description: The equipment is indicating that it is waiting for an operator action to be performed.

Attribute Name	Attribute Type	Description	Occ
dateTime	dateTime	Date and time of the event	1-1
description	string	Description of operator action required	1-1

```
<WaitingforOperatorAction
  dateTime="2000-02-02T11:57:22.00-05:00"
  description="Waiting for parts replenishment"
/>
```

8 Equipment Flow Event Scenarios – Single Lane Equipment

8.1 Scenario 1 – Single Working Zone, Single Item

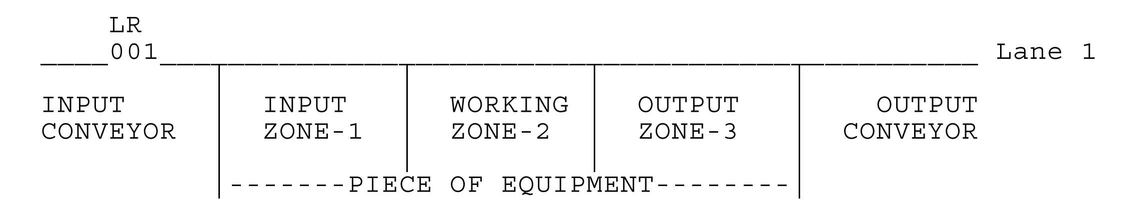
Scenario - Equipment idle; single item enters system and is processed. Equipment has single lane, single working zone.
Note: LR is a label reader.

```
    LR

_______________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED



Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.
Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved

```
    LR
______________001______________________________________ Lane 1
              |          |          |           |
INPUT         |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR      |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
              |          |          |           |
              |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item begins.

Event:	ItemWorkStart
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T10:35:12.00-05:00
itemInstanceId:	001
laneId:	1
zoneId:	2

Event:	EquipmentChangeState
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T10:35:12.00-05:00
previousState:	READY-PROCESSING-ACTIVE
currentState:	READY-PROCESSING-EXECUTING
eventId:	ItemWorkStart

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |   CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
____________________________________001________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:33.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

```
    LR
__________________________________________________001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes. Equipment becomes starved as no items are available.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:38.00-05:00
itemInstanceId: 001
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:38.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:38.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

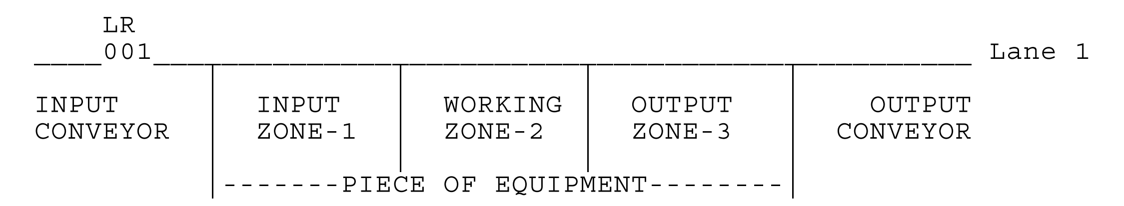
8.2 Scenario 2 – Single Working Zone, Multiple Items

Scenario - Equipment idle; two items enter system and are processed. Equipment has single lane, single working zone.

```
    LR
________________________________________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |    OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED



Action: First item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.
Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event:	ItemIdentifierRead
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00
itemInstanceId:	001
laneId:	1
zoneId:	1
scannerId:	Input Conveyor, Placer 1-IC

Event:	EquipmentUnStarved
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00

Event:	EquipmentChangeState
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00
previousState:	READY-IDLE-STARVED
currentState:	READY-PROCESSING-ACTIVE
eventId:	EquipmentUnStarved

```
    LR
____002_______001_______________________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    | WORKING   | OUTPUT     |   OUTPUT
CONVEYOR  |  ZONE-1   | ZONE-2    | ZONE-3     |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Input Zone completes. Label of second item read.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:06.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

```
    LR
______________002________001___________________________ Lane 1
              |           |           |            |
INPUT         |  INPUT    |  WORKING  |  OUTPUT    |     OUTPUT
CONVEYOR      |  ZONE-1   |  ZONE-2   |  ZONE-3    |     CONVEYOR
              |           |           |            |
              |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Second item enters equipment.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemInstanceId: 002
laneId: 1

```
    LR
______________002________001___________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |    OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of first item begins.

Event:	ItemWorkStart
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T10:35:12.00-05:00
itemInstanceId:	001
laneId:	1
zoneId:	2

Event:	EquipmentChangeState
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T10:35:12.00-05:00
previousState:	READY-PROCESSING-ACTIVE
currentState:	READY-PROCESSING-EXECUTING
eventId:	ItemWorkStart

```
    LR
______________002________001___________________________ Lane 1
              |          |          |            |
INPUT         |  INPUT   |  WORKING |  OUTPUT    |   OUTPUT
CONVEYOR      |  ZONE-1  |  ZONE-2  |  ZONE-3    |  CONVEYOR
              |          |          |            |
              |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of first item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
_________________________002________001________________ Lane 1
          |          |          |            |
INPUT     |   INPUT  |  WORKING |  OUTPUT    |   OUTPUT
CONVEYOR  |   ZONE-1 |  ZONE-2  |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:33.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of second item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:37.00-05:00
itemInstanceId: 002
fromZoneId: 1
toZoneId: 2
laneId: 1

```
    LR
_________________________002_____________________001___ Lane 1
          |           |          |          |
INPUT     |  INPUT    | WORKING  | OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1   | ZONE-2   | ZONE-3   |   CONVEYOR
          |           |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:38.00-05:00
itemInstanceId: 001
laneId: 1

```
    LR
_________________________002_____________________001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of second item begins.

Event: ItemWorkStart
State: Ready-Processing-Executing
Message:
dateTime: 2000-02-02T10:35:39.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:39.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
    LR
_________________________002___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |     OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |    CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of second item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:59.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:59.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
____________________________________002________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of second item to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:00.00-05:00
itemInstanceId: 002
fromZoneId: 2
toZoneId: 3
laneId: 1

```
    LR
_______________________________________________________002___ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of second item to Output Conveyor completes. Equipment becomes starved as no items are available.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:05.00-05:00
itemInstanceId: 002
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:05.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:05.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

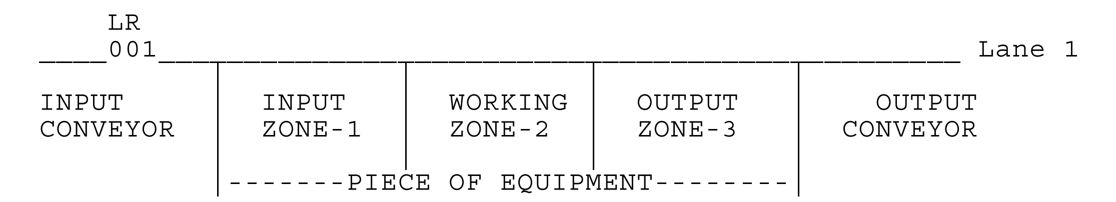
8.3 Scenario 3 – Single Working Zone, Multiple Items, Downstream Bottleneck

Scenario - Equipment idle; unspecified number of items enter the system and are processed. A gap in the entry of items results in an equipment starved condition. Subsequently a downstream bottleneck results in an equipment blocked condition. Equipment has single lane, single working zone.

```
    LR
_______________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED



Action: First item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.
Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event:	ItemIdentifierRead
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00
itemInstanceId:	001
laneId:	1
zoneId:	1
scannerId:	Input Conveyor, Placer 1-IC

Event:	EquipmentUnStarved
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00

Event:	EquipmentChangeState
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:00.00-05:00
previousState:	READY-IDLE-STARVED
currentState:	READY-PROCESSING-ACTIVE
eventId:	EquipmentUnStarved

```
    LR
____002_______001______________________________________ Lane 1
          |           |          |            |
INPUT     |  INPUT    |  WORKING |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2  |  ZONE-3    |  CONVEYOR
          |           |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Input Zone completes. Label of second item read.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:06.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

```
    LR
______________002________001___________________________ Lane 1
          |           |          |            |
INPUT     |  INPUT    |  WORKING |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2  |  ZONE-3    |  CONVEYOR
          |           |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Second item enters equipment.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemInstanceId: 002
laneId: 1

```
    LR
______________002_________001___________________________ Lane 1
              |           |           |            |
INPUT         |  INPUT    |  WORKING  |  OUTPUT    |    OUTPUT
CONVEYOR      |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
              |           |           |            |
              |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of first item begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
    LR
______________002________001___________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |   CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of first item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
_________________________002________001__________XXX__ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of first item to Output Zone completes. Note: First item can proceed no further due to downstream bottleneck.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:33.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of second item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:37.00-05:00
itemInstanceId: 002
fromZoneId: 1
toZoneId: 2
laneId: 1

```
    LR
_________________________002________001__________XXX___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |   CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of second item begins.

Event: ItemWorkStart
State: Ready-Processing-Executing
Message:
dateTime: 2000-02-02T10:35:39.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:39.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
    LR
_________________________002________001___________XXX__ Lane 1
          |          |          |          |
INPUT     |  INPUT   |  WORKING |  OUTPUT  |    OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3  |  CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of second item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:59.00-05:00
itemInstanceId: 002
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:59.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
_________________________002________001___________XXX__ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Equipment becomes starved as no unprocessed items are present and space is available to accept additional items.

Event: EQUIPMENTSTARVED
STATE: READY-Idle-Starved
Message:
dateTime: 2000-02-02T10:36:00.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:00.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

```
    LR
____003__________________002________001___________XXX__ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Additional item becomes available and enters system for processing. When item becomes available on Input conveyor equipment no longer starved.

Event:	ItemIdentifierRead
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T10:36:30.00-05:00
itemInstanceId:	003
laneId:	1
zoneId:	1
scannerId:	Input Conveyor, Placer 1-IC

Event:	EquipmentUnStarved
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:36:30.00-05:00
laneId:	1

Event:	EquipmentChangeState
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:36:30.00-05:00
previousState:	READY-IDLE-STARVED
currentState:	READY-PROCESSING-ACTIVE
eventId:	EquipmentUnStarved

```
    LR
______________003________002________001___________XXX__ Lane 1
             |           |           |            |
INPUT        |  INPUT    |  WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR     |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
             |           |           |            |
             |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of third item to Input Zone completes. Equipment becomes blocked as there are no unprocessed items in working zone(s) and equipment unable to accept any additional items.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:35.00-05:00
itemInstanceId: 003
laneId: 1

Event: EquipmentBlocked
State: READY-IDLE-BLOCKED
Message:
dateTime: 2000-02-02T10:36:35.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-BLOCKED
Message:
dateTime: 2000-02-02T10:36:35.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-BLOCKED
eventId: EquipmentBlocked

```
    LR
______________003________002________001________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Downstream bottleneck clears and equipment becomes unblocked.

Event: EquipmentUnBlocked
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:45.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:45.00-05:00
previousState: READY-IDLE-BLOCKED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnBlocked

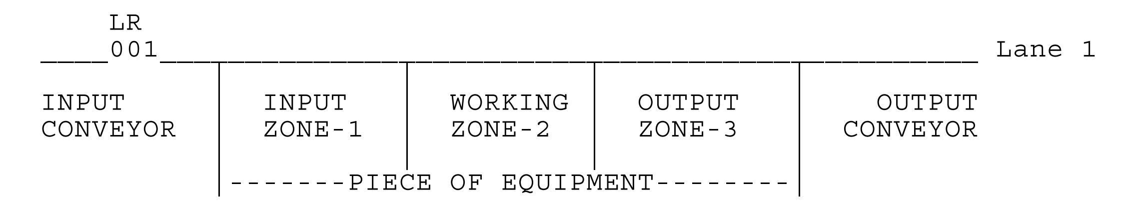
8.4 Scenario 4 – Single Working Zone, Equipment Error

Scenario - Equipment idle; single item enters system and processing starts - error occurs during processing. Equipment has single lane, single working zone.

```
    LR
_______________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED



Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.
Note: The Label Reader is part of the Input Conveyor - not the equipment. The message headers will indicate the source of each message. For pieces of equipment with internal label readers the EquipmentUnStarved event would precede the ItemIdentifierRead event.

Event: ItemIdentifierRead
State: Ready-Idle-Starved
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved

```
    LR
______________001______________________________________ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |    OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |   CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1

```
    LR
_________________________001___________________________ Lane 1
          |           |           |            |
INPUT     |   INPUT   |  WORKING  |  OUTPUT    |      OUTPUT
CONVEYOR  |   ZONE-1  |  ZONE-2   |  ZONE-3    |    CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

```
    LR
_________________________001___________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |   CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:12.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
    LR
________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Error - parts run out - occurs during processing.

Event:	EquipmentError
State:	DOWN
Message:	
dateTime:	2000-02-02T10:35:22.00-05:00
errorId:	321
errorInstanceId:	321-001
laneList:	1
zoneList:	1-3,5

Event:	EquipmentChangeState
State:	DOWN
Message:	
dateTime:	2000-02-02T10:35:22.00-05:00
previousState:	Ready-Processing-Executing
currentState:	DOWN
eventId:	EquipmentError

```
    LR
_________________________001___________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Operator replenishes part and clears errors.

Event: EquipmentErrorCleared
State: DOWN
Message:
dateTime: 2000-02-02T10:36:30.00-05:00
errorInstanceId: 321-001

Event: EquipmentErrorsCleared
State: DOWN
Message:
dateTime: 2000-02-02T10:36:30.00-05:00

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Operator signals for processing to resume.

Event: EquipmentStartSelected
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:36:31.00-05:00
eventInitator: Operator 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:36:31.00-05:00
previousState: Down
currentState: READY-PROCESSING-EXECUTING
eventId: EquipmentStartSelected

Event: ItemWorkResume
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:36:32.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:42.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:42.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
    LR
____________________________________001________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:43.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

```
    LR
__________________________________________________001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes. Equipment becomes starved as no items are available.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:36:48.00-05:00
itemInstanceId: 001
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:48.00-05:00
laneId: 1

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:36:48.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

9 Equipment Flow Event Scenarios – Dual Lane Equipment

9.1 Scenario 5 – Single Working Zone, Single Item

Scenario – Equipment has dual lanes. Equipment Idle; single item enters lane and is processed. During this time a single item enters lane 2 and is processed. Equipment has dual lanes, single working zone, three heads, label reading capability on both lanes.

Note: LR is a label reader.

```
LR

_______________________________________________________ Lane 2
_______________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

Event: -
State: READY-IDLE-STARVED

```
LR
_________________________________________________________ Lane 2
____001__________________________________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    | WORKING   |  OUTPUT    |    OUTPUT
CONVEYOR  |  ZONE-1   | ZONE-2    |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Single item enters the system for processing, equipment no longer starved.

Event: ItemIdentifierRead
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: LaneUnStarved
State: No State Change
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
laneId: 1

Event: EquipmentUnStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnStarved

```
    LR

______________________________________________________ Lane 2
______________001_____________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:05.00-05:00
itemInstanceId: 001
laneId: 1

```
    LR

__002_______________________________________________________ Lane 2
___________________________001______________________________ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |     OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |   CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Working Zone completes.

Event:	ItemTransferZone
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:06.00-05:00
itemInstanceId:	001
fromZoneId:	1
toZoneId:	2
laneId:	1

Event:	ItemIdentifierRead
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:07.00-05:00
itemInstanceId:	002
laneId:	2
zoneId:	1
scannerId:	Input Conveyor, Placer 2-IC

Event:	LaneUnstarved
State:	READY-PROCESSING-ACTIVE
Message:	
dateTime:	2000-02-02T10:35:08.00-05:00
laneId:	2

```
    LR
_____________002_______________________________________ Lane 2
_________________________001___________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |     OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |   CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item 001 begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:09.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
Previousstate: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

Action: Transfer of item to Input Zone completes.

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:10.00-05:00
itemInstanceId: 002
laneId: 2

```
LR
_________________________002___________________________ Lane 2
_________________________001___________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemInstanceId: 002
fromZoneId: 1
toZoneId: 2
laneId: 2

```
LR
__________________________002____________________________ Lane 2
__________________________001____________________________ Lane 1
           |           |           |            |
INPUT      |  INPUT    | WORKING   | OUTPUT     |   OUTPUT
CONVEYOR   |  ZONE-1   | ZONE-2    | ZONE-3     | CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item 002 begins.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:11.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 2

```
    LR
_________________________002___________________________ Lane 2
_________________________001___________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item 001 completes.

Event: ItemWorkComplete
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:20.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR
_________________________002____________________________Lane 2
____________________________________001________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 001 to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:21.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

Equipment state remains: READY-PROCESSING-EXECUTING

```
    LR
_________________________002___________________________ Lane 2
_________________________________________________001___ Lane 1
          |          |          |           |
INPUT     |   INPUT  |  WORKING |  OUTPUT   |     OUTPUT
CONVEYOR  |   ZONE-1 |  ZONE-2  |  ZONE-3   |   CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:35:21.00-05:00
itemInstanceId: 001
laneId: 1

Event: LaneStarved
dateTime: 2000-02-02T10:35:21.00-05:00
laneId: 1

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR
_________________________002___________________________ Lane 2
_______________________________________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   | WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item 002 completes.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:31.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:31.00-05:00
previousState: READY-PROCESSING-EXCECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
LR
____________________________________002_________________Lane 2
________________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:31.00-05:00
itemInstanceId: 002
fromZoneId: 2
toZoneId: 3
laneId: 2

Equipment state remains: READY-PROCESSING-ACTIVE

```
LR
______________________________________________002_______Lane 2
_______________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |   CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Output Conveyor completes. Equipment becomes starved

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
itemInstanceId: 002
laneId: 2

Event: LaneStarved
State: No State Change
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
laneId: 2

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:32.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T10:35:32.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

9.2 Scenario 6 – Single Working Zone, Multiple Items

Equipment has dual lanes, single working zone, multiple items, label reading capability on both lanes.

Note: LR is a label reader.

Scenario:
Equipment OFF.
Equipment is turned on and a recipe selected.
A single item enters lane 1.
Processing begins on the product item in lane 1.
A single item enters lane 2.
Processing begins on the product item in lane 2.
Other product items are introduced at each lane.

Exceptions:
Equipment error on lane 2 (cleared)
Lane starved on lane 2
Lane blocked on lane 1
Equipment blocked
Equipment starved
Equipment stopped

LR

```
_____________________________________________________ Lane 2
_____________________________________________________ Lane 1
          |          |          |          |
INPUT     |  INPUT   | WORKING  |  OUTPUT  |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3  |  CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Machine turned on. No items anywhere.

Event: EquipmentInitializationComplete
State: SETUP
Message:
dateTime: 2000-02-02T09:30:00.00-05:00
softwareRev: Rev 3.2.0
hardwareRev: Rev 7-B

Event: EquipmentChangeState
State: SETUP
Message:
dateTime: 2000-02-02T09:30:00.00-05:00
previousState: OFF
currentState: SETUP
eventId: EquipmentInitializationComplete

Event: EquipmentInformation
State: SETUP
Message:
dateTime: 2000-02-02T09:30:00.00-05:00
informationId: “Good Morning Hal”
laneList: 1-2
zoneList: 1-3

LR

```
______________________________________________________ Lane 2
______________________________________________________ Lane 1
           |           |           |            |
INPUT      |   INPUT   |  WORKING  |   OUTPUT   |  OUTPUT
CONVEYOR   |   ZONE-1  |  ZONE-2   |   ZONE-3   |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Recipe is selected for lanes 1 & 2. Equipment indicates when the selected recipe is ready to run. The host computer for the line brings the equipment to the Ready state.

Event: EquipmentRecipeSelected
State: SETUP
Message:
dateTime: 2000-02-02T09:30:05.00-05:00
recipeId: 12345.A
laneList: 1-2
zoneList: 1-3

Event: EquipmentRecipeReady
State: SETUP
Message:
dateTime: 2000-02-02T09:30:21.00-05:00
recipeId: 12345.A
laneList: 1-2
zoneList: 1-3

Event: EquipmentStartSelected
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:30:25.00-05:00
eventInitator: SMT Line 2-A host

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:30:25.00-05:00
previousState: SETUP
currentState: READY-PROCESSING-EXECUTING
eventId: EquipmentStartSelected

LR

```
_____________________________________________________ Lane 2
_____________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Equipment is now ready to process product but no items are available - it is starved.

Event:	LaneStarved
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T09:30:25.00-05:00
laneId:	1
Event:	LaneStarved
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T09:30:25.00-05:00
laneId:	2
Event:	EquipmentStarved
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T09:30:25.00-05:00
Event:	EquipmentChangeState
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T09:30:25.00-05:00
previousState:	READY-PROCESSING-EXECUTING
currentState:	READY-IDLE-STARVED
eventId:	EquipmentStarved

```
LR

_____________________________________________________ Lane 2
____001______________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

Event:	ItemIdentifierRead
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T09:31:00.00-05:00
itemInstanceId:	001
laneId:	1
zoneId:	1
scannerId:	Input Conveyor, Placer 1-IC

Event:	LaneUnStarved
State:	READY-IDLE-STARVED
Message:	
dateTime:	2000-02-02T09:31:00.00-05:00
laneId:	1

Event:	EquipmentUnStarved
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T09:31:00.00-05:00

Event:	EquipmentChangeState
State:	READY-PROCESSING-EXECUTING
Message:	
dateTime:	2000-02-02T09:31:00.00-05:00
previousState:	READY-IDLE-STARVED
currentState:	READY-PROCESSING-EXECUTING
eventId:	EquipmentUnStarved

```
LR

__002_________________________________________________ Lane 2
______________001_____________________________________ Lane 1
               |           |           |            |
INPUT          |  INPUT    |  WORKING  |  OUTPUT    |  OUTPUT
CONVEYOR       |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
               |           |           |            |
               |-------PIECE OF EQUIPMENT--------|
```

Action: Second item enters the system for processing. Item becomes available on the Input Conveyor on lane 2.
Lane 2 is no longer starved, but since lane 1 was already active there is no equipment state change.

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:02.00-05:00
itemInstanceId: 001
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:03.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: LaneUnStarved
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:03.00-05:00
laneId: 2

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR

____________002______________________________________ Lane 2
___003____________________001________________________ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |  OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:31:10.00-05:00
itemInstanceId: 001
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:31:11.00-05:00
itemInstanceId: 002
laneId: 2

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:31:12.00-05:00
itemInstanceId: 003
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:13.00-05:00
itemInstanceId: 001
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:13.00-05:00
previousState: Ready-Processing-Active
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
LR
__________________________002____________________________ Lane 2
_____________003_________001____________________________ Lane 1
           |           |           |            |
INPUT      |  INPUT    | WORKING   |  OUTPUT    |   OUTPUT
CONVEYOR   |  ZONE-1   | ZONE-2    |  ZONE-3    |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:15.00-05:00
itemInstanceId: 002
fromZoneId: 1
toZoneId: 2
laneId: 2

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:16.00-05:00
itemInstanceId: 002
laneId: 2

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:16.00-05:00
itemInstanceId: 003
laneId: 1

Equipment state remains: READY-PROCESSING-EXECUTING

```
     LR
____004____________________002__________________________ Lane 2
_______________003_________001__________________________ Lane 1
              |           |           |            |
INPUT         |  INPUT    | WORKING   | OUTPUT     |  OUTPUT
CONVEYOR      |  ZONE-1   | ZONE-2    | ZONE-3     | CONVEYOR
              |           |           |            |
              |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item 001 completes.

Event: ItemWorkComplete
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T10:31:58.00-05:00
itemInstanceId: 001
laneId: 1
zoneId: 2

Action: Board available at input.

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:31:58.00-05:00
itemInstanceId: 004
laneId: 2
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR
______________004________002__________________________ Lane 2
____005_________________003_________001_____________ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |  OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 001 to Output Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:00.00-05:00
itemInstanceId: 001
fromZoneId: 2
toZoneId: 3
laneId: 1

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:00.00-05:00
itemInstanceId: 004
laneId: 2

Action: Transfer of item 003 to Working Zone completes.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:02.00-05:00
itemInstanceId: 003
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:03.00-05:00
itemInstanceId: 005
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR
______________004_________002__________________________ Lane 2
____005___________________003_____________________001___ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |  OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Processing complete on item 002.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:31:58.00-05:00
itemInstanceId: 002
laneId: 2
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:32:00.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

Action: Transfer of item 001 to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T10:32:00.00-05:00
itemInstanceId: 001
laneId: 1

Action: Processing begins on board 003.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:05.00-05:00
itemInstanceId: 003
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:05.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
LR
_________________________004________002______________ Lane 2
______________005________003____________________001___ Lane 1
          |          |          |          |
INPUT     |  INPUT   | WORKING  |  OUTPUT  |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3  | CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:09.00-05:00
itemInstanceId: 002
fromZoneId: 2
toZoneId: 3
laneId: 2

Action: Item 004 transfers to work zone.

Event: ItemTransferZone
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:10.00-05:00
itemInstanceId: 004
fromZoneId: 1
toZoneId: 2
laneId: 2

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:11.00-05:00
itemInstanceId: 005
laneId: 1

Action: Processing begins on board 004.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:32:12.00-05:00
itemInstanceId: 004
laneId: 2

Equipment state remains: READY-PROCESSING-EXECUTING

```
LR
_________________________004________002______________ Lane 2
______________005________003___________________001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Equipment Error on Lane 2 in Zone 3

Event: EquipmentError
State: DOWN
Message:
dateTime: 2000-02-02T09:32:15.00-05:00
errorId: Head Crash
errorInstanceId: 024
laneList: 2
zoneList: 3

Event: EquipmentChangeState
State: DOWN
Message:
dateTime: 2000-02-02T09:32:15.00-05:00
previousState: Ready-Processing-Executing
currentState: DOWN
eventId: EquipmentError

Action: Processing aborted for item 004.

Event: ItemWorkAbort
State: DOWN
Message:
dateTime: 2000-02-02T09:35:57.00-05:00
itemInstanceId: 004
laneId: 2
zoneId: 3
abortId: Head Crash

Action: Operator removes item 004 damaged by the head crash. Using the operator interface the operator indicates the removal to the equipment which issues the appropriate message.

Event: ItemTransferZone
State: DOWN
Message:
dateTime: 2000-02-02T09:37:43.00-05:00
itemInstanceId: 004
fromZomeId : 2
toZoneId: “Removed”
laneId: 2

```
LR
____________________________________002______________ Lane 2
___006________005________003___________________001___ Lane 1
          |          |          |          |
INPUT     |  INPUT   | WORKING  | OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   | ZONE-3   | CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Equipment Error Cleared

Event: EquipmentErrorCleared
State: DOWN
Message:
dateTime: 2000-02-02T09:42:00.00-05:00
errorInstanceId: 024

Event: EquipmentStartSelected
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:02.00-05:00
eventInitiator: Hal

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:02.00-05:00
previousState: DOWN
currentState: READY-PROCESSING-EXECUTING
eventId: EquipmentStartSelected

Event: ItemWorkResume
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:05.00-05:00
itemInstanceId: 003
laneId: 1

Event: ItemIdentifierRead
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:06.00-05:00
itemInstanceId: 006
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

```
LR
_______________________________________________002___ Lane 2
___006________005________003___________________001___ Lane 1
          |          |          |          |
INPUT     |  INPUT   | WORKING  |  OUTPUT  |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3  | CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 002 to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:07.00-05:00
itemInstanceId: 002
laneId: 2

Event: LaneStarved
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:07.00-05:00
laneId: 2

```
LR
___________________________________________________ Lane 2
___006________005________003__________________001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing complete on item 003.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:20.00-05:00
itemInstanceId: 003
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:20.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
____________________________________________________ Lane 2
______________006________005__________003_______001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 003 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:21.00-05:00
itemInstanceId: 003
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of item 005 to Zone 2.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:21.00-05:00
itemInstanceId: 005
fromZoneId: 1
toZoneId: 2
laneId: 1

Action: Transfer of item 006 to Input.

Event: ItemTransferIn
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:22.00-05:00
itemInstanceId: 006
laneId: 1

```
_____________________________________________________ Lane 2
___007________006________005_________003_______001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Additional item enters system.

Event: ItemIdentifierRead
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:23.00-05:00
itemInstanceId: 007
laneId: 1
zoneId: 1
scannerId: Input Conveyor, Placer 1-IC

Action: Processing begins on board 005.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:25.00-05:00
itemInstanceId: 005
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:42:25.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
LR
______________________________________________________ Lane 2
___007________006________005_________003_______001___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing complete on item 005. Equipment becomes blocked as all possible work has been completed but equipment is unable to to transfer item out due to downstream blockage.

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:30.00-05:00
itemInstanceId: 005
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:30.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

Event: LaneBlocked
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:42:30.00-05:00
laneId: 1

Event: EquipmentBlocked
State: READY-IDLE-BLOCKED
Message:
dateTime: 2000-02-02T09:42:30.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-BLOCKED
Message:
dateTime: 2000-02-02T09:42:30.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-BLOCKED
eventId: EquipmentBlocked

```
LR
____________________________________________________ Lane 2
___007_________006_________005__________003_____________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Downstream blockage removed.

Event: LaneUnBlocked
State: READY-IDLE-BLOCKED
Message:
dateTime: 2000-02-02T09:43:00.00-05:00
laneId: 1

Event: EquipmentUnBlocked
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:00.00-05:00

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:00.00-05:00
previousState: READY-IDLE-BLOCKED
currentState: READY-PROCESSING-ACTIVE
eventId: EquipmentUnBlocked

```
LR
____________________________________________________ Lane 2
____007___________________006_________005________003___ Lane 1
                |          |          |           |
INPUT           |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR        |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
                |          |          |           |
                |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:02.00-05:00
itemInstanceId: 003
laneId: 1

Action: Transfer of item 005 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:21.00-05:00
itemInstanceId: 005
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of item 006 to Work Zone 2.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:22.00-05:00
itemInstanceId: 006
fromZoneId: 1
toZoneId: 2
laneId: 1

```
LR
_____________________________________________________ Lane 2
______________007________006__________005________003___ Lane 1
          |           |           |            |
INPUT     |  INPUT    |  WORKING  |  OUTPUT    |  OUTPUT
CONVEYOR  |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
          |           |           |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of items continues.

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:43:23.00-05:00
itemInstanceId: 006
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:43:23.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

Event: ItemTransferIn
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:43:24.00-05:00
itemInstanceId: 007
laneId: 1

```
LR
______________________________________________________ Lane 2
______________007_________006_____________________005__ Lane 1
           |           |           |            |
INPUT      |  INPUT    | WORKING   | OUTPUT     | OUTPUT
CONVEYOR   |  ZONE-1   | ZONE-2    | ZONE-3     | CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:43:25.00-05:00
itemInstanceId: 005
laneId: 1

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:30.00-05:00
itemInstanceId: 006
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:43:30.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
LR
_____________________________________________________ Lane 2
_________________________007__________006____________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item 006 to Output Zone 3.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:44:32.00-05:00
itemInstanceId: 006
fromZoneId: 2
toZoneId: 3
laneId: 1

Action: Transfer of item 007 to Work Zone 2.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:44:33.00-05:00
itemInstanceId: 007
fromZoneId: 1
toZoneId: 2
laneId: 1

Event: ItemWorkStart
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:44:43.00-05:00
itemInstanceId: 007
laneId: 1

Event: EquipmentChangeState
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:44:43.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-PROCESSING-EXECUTING
eventId: ItemWorkStart

```
LR
_____________________________________________________ Lane 2
_________________________007___________________006___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-EXECUTING
Message:
dateTime: 2000-02-02T09:44:45.00-05:00
itemInstanceId: 006
laneId: 1

Event: ItemWorkComplete
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 000-02-02T09:45:43.00-05:00
itemInstanceId: 007
laneId: 1
zoneId: 2

Event: EquipmentChangeState
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 000-02-02T09:45:43.00-05:00
previousState: READY-PROCESSING-EXECUTING
currentState: READY-PROCESSING-ACTIVE
eventId: ItemWorkComplete

```
LR
_____________________________________________________ Lane 2
____________________________________007______________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Last item moves to output zone.

Event: ItemTransferZone
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:45:45.00-05:00
itemInstanceId: 007
fromZoneId: 2
toZoneId: 3
laneId: 1

```
LR
_____________________________________________________ Lane 2
_______________________________________________007___ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of last item to Output Conveyor completes.

Event: ItemTransferOut
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:45:47.00-05:00
itemInstanceId: 007
laneId: 1

Event: LaneStarved
State: READY-PROCESSING-ACTIVE
Message:
dateTime: 2000-02-02T09:45:47.00-05:00
laneId: 1

Event: EquipmentStarved
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T09:45:47.00-05:00

Event: EquipmentChangeState
State: READY-IDLE-STARVED
Message:
dateTime: 2000-02-02T09:45:47.00-05:00
previousState: READY-PROCESSING-ACTIVE
currentState: READY-IDLE-STARVED
eventId: EquipmentStarved

```
LR
____________________________________________________ Lane 2
____________________________________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |  OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   | CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Operator selects the down state.

Event: EquipmentDownSelected
State: DOWN
Message:
dateTime: 2000-02-02T09:46:00.00-05:00
eventInitiator: Hal

Event: EquipmentChangeState
State: DOWN
Message:
dateTime: 2000-02-02T09:46:00.00-05:00
previousState: READY-IDLE-STARVED
currentState: DOWN
eventId: EquipmentDownSelected

10 2541 XML Schema

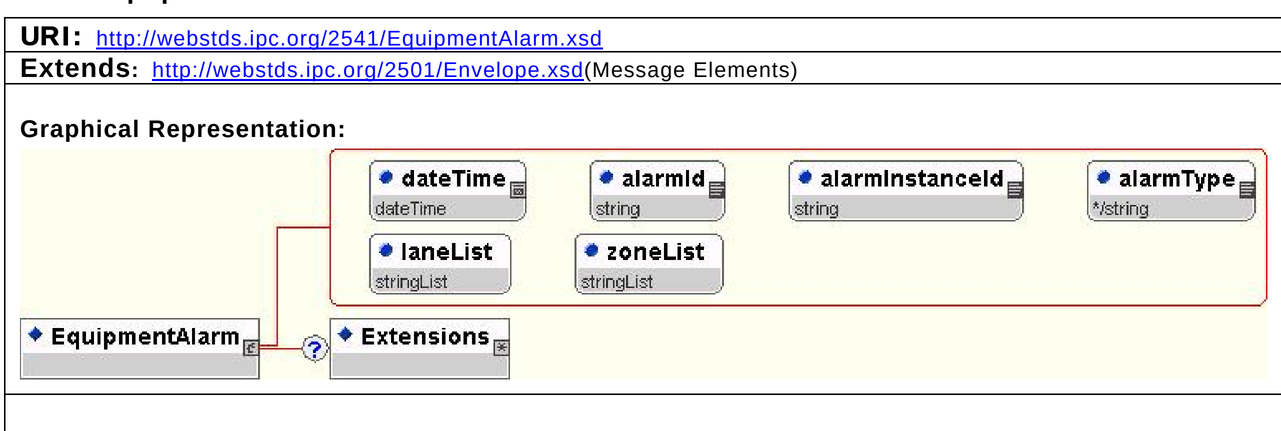
Here is the complete listing of the XML schema for IPC-2541. The Uniform Resource Indicator (URI) for each IPC-2541 schema is listed first, followed by the XML schema for the IPC-2501 schema that it extends. A graphical representation of each IPC-2541 schema is then shown, followed by the actual schema definition for each of the 2541 events.

10.1 EquipmentAlarm

URI: http://webstds.ipc.org/2541/EquipmentAlarm.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd(Message Elements)

Graphical Representation:



Schema:

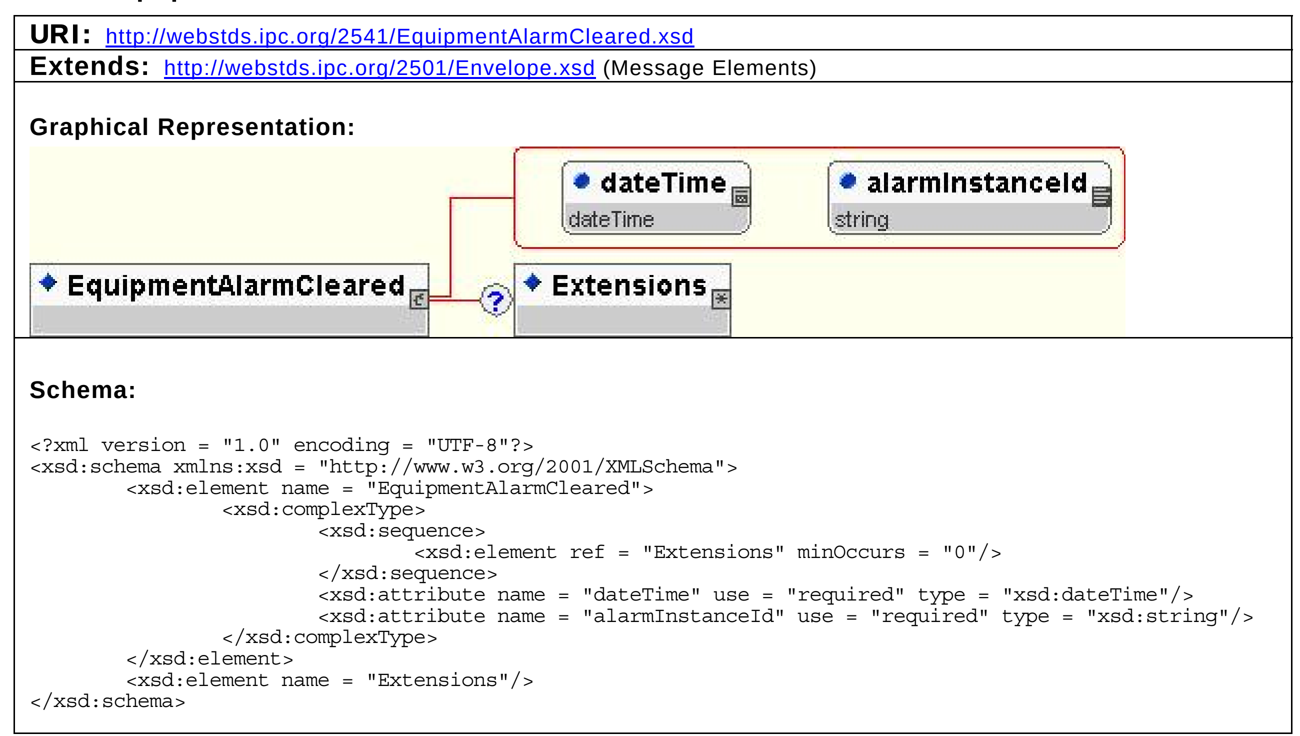
```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentAlarm">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "alarmId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "alarmInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "alarmType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "PERSONALSAFETY"/>
                                                <xsd:enumeration value = "EQUIPMENTSAFETY"/>
                                                <xsd:enumeration value = "ITEMSAFETY"/>
                                                <xsd:enumeration value = "PARAMETERCONTROLALARM"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "laneList" use = "required" type = "stringList"/>
                        <xsd:attribute name = "zoneList" use = "required" type = "stringList"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.2 EquipmentAlarmCleared

URI: http://webstds.ipc.org/2541/EquipmentAlarmCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

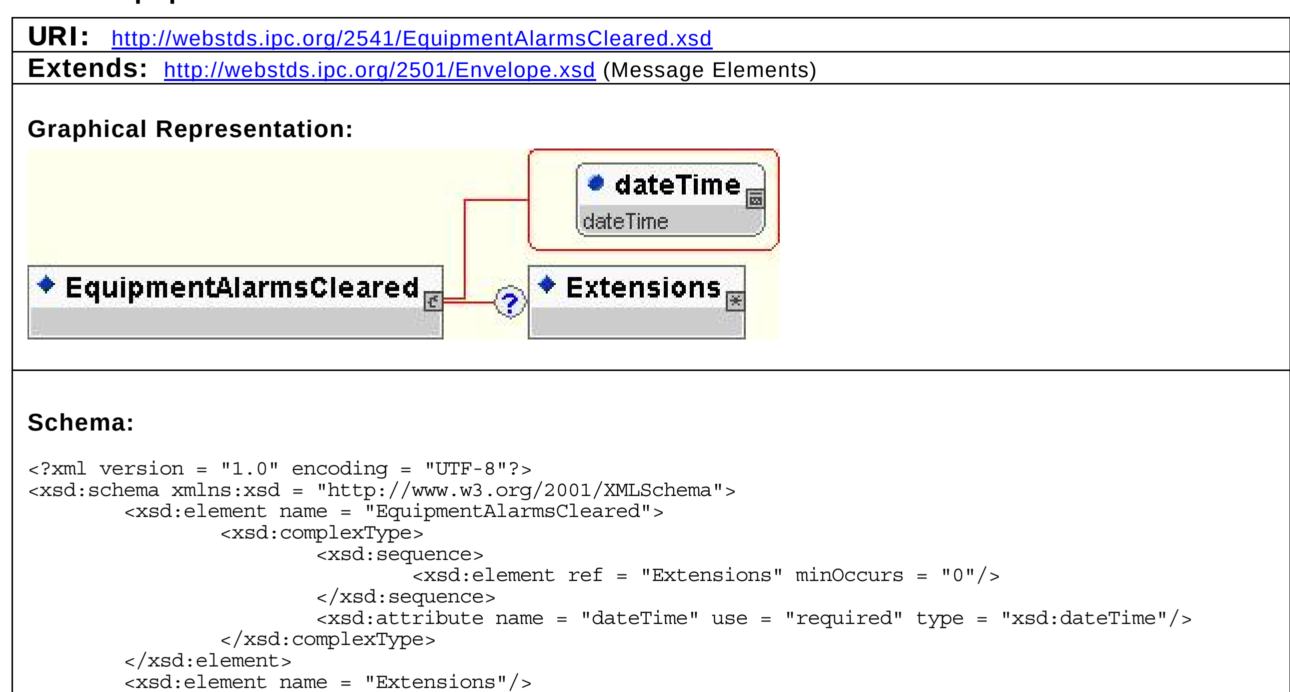
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentAlarmCleared">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "alarmInstanceId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.3 EquipmentAlarmsCleared

URI: http://webstds.ipc.org/2541/EquipmentAlarmsCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "EquipmentAlarmsCleared">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.4 EquipmentBlocked

URI: http://webstds.ipc.org/2541/EquipmentBlocked.xsd

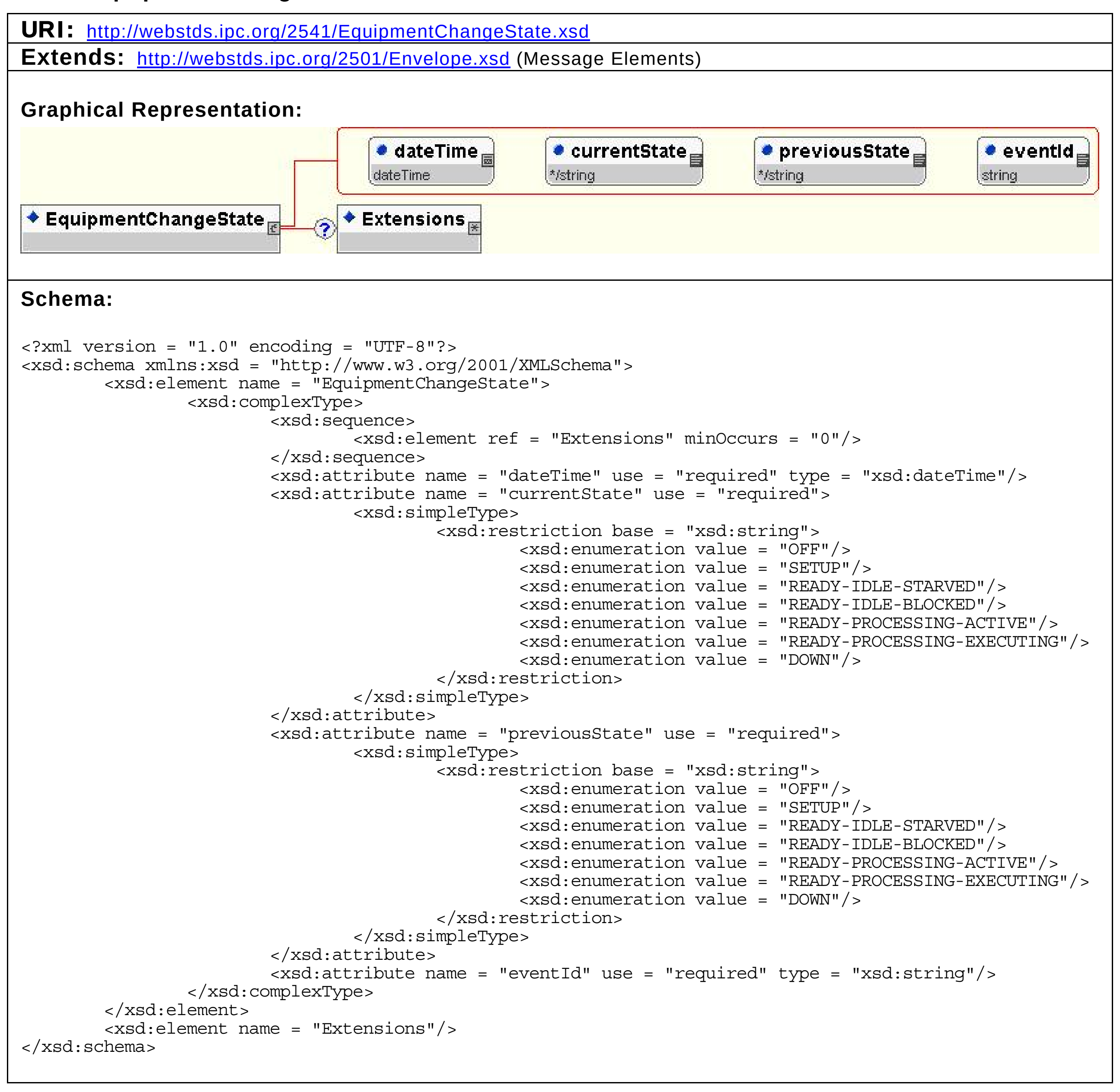
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentAlarmsCleared">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.5 EquipmentChangeState



URI: http://webstds.ipc.org/2541/EquipmentChangeState.xsd

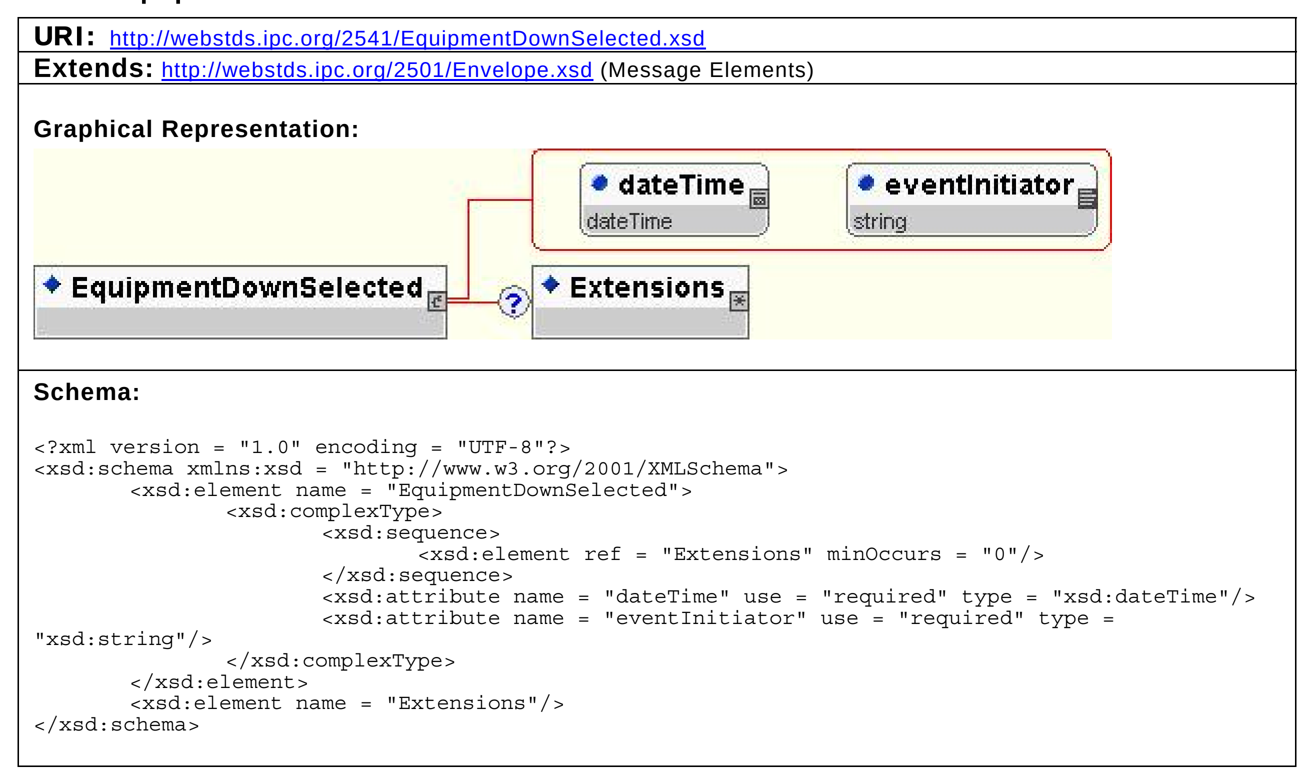
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentChangeState">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "currentState" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OFF"/>
                                                <xsd:enumeration value = "SETUP"/>
                                                <xsd:enumeration value = "READY-IDLE-STARVED"/>
                                                <xsd:enumeration value = "READY-IDLE-BLOCKED"/>
                                                <xsd:enumeration value = "READY-PROCESSING-ACTIVE"/>
                                                <xsd:enumeration value = "READY-PROCESSING-EXECUTING"/>
                                                <xsd:enumeration value = "DOWN"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "previousState" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OFF"/>
                                                <xsd:enumeration value = "SETUP"/>
                                                <xsd:enumeration value = "READY-IDLE-STARVED"/>
                                                <xsd:enumeration value = "READY-IDLE-BLOCKED"/>
                                                <xsd:enumeration value = "READY-PROCESSING-ACTIVE"/>
                                                <xsd:enumeration value = "READY-PROCESSING-EXECUTING"/>
                                                <xsd:enumeration value = "DOWN"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "eventId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.6 EquipmentDownSelected



URI: http://webstds.ipc.org/2541/EquipmentDownSelected.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

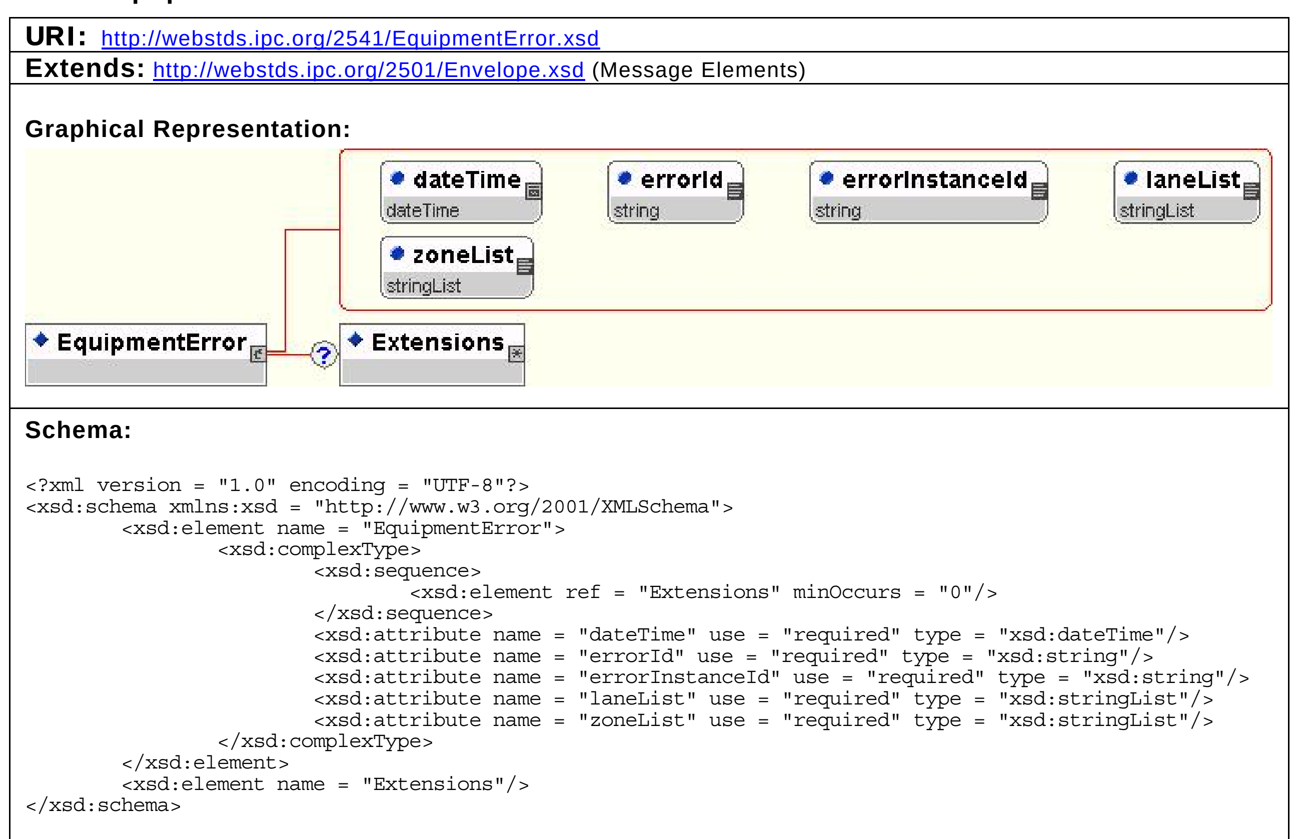
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentDownSelected">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "eventInitiator" use = "required" type =
"xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.7 EquipmentError

URI: http://webstds.ipc.org/2541/EquipmentError.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

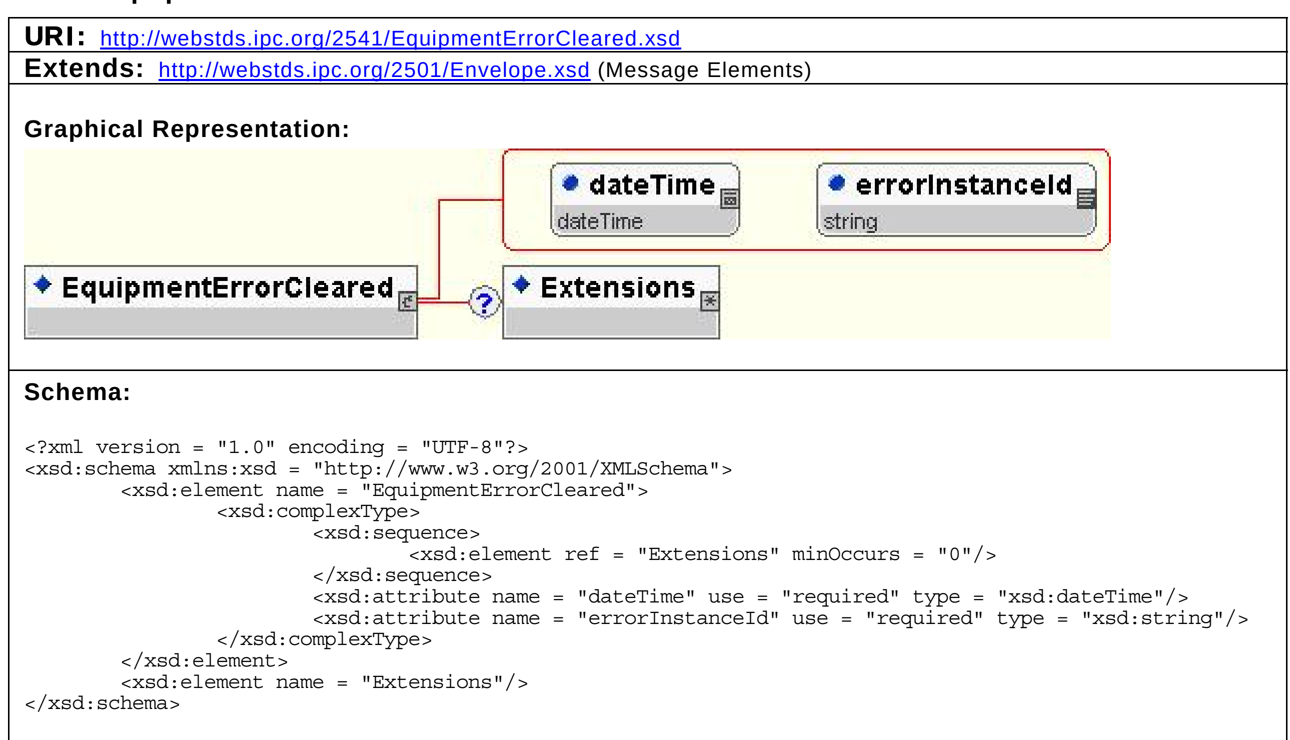
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentError">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "errorId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "errorInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
                        <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.8 EquipmentErrorCleared

URI: http://webstds.ipc.org/2541/EquipmentErrorCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

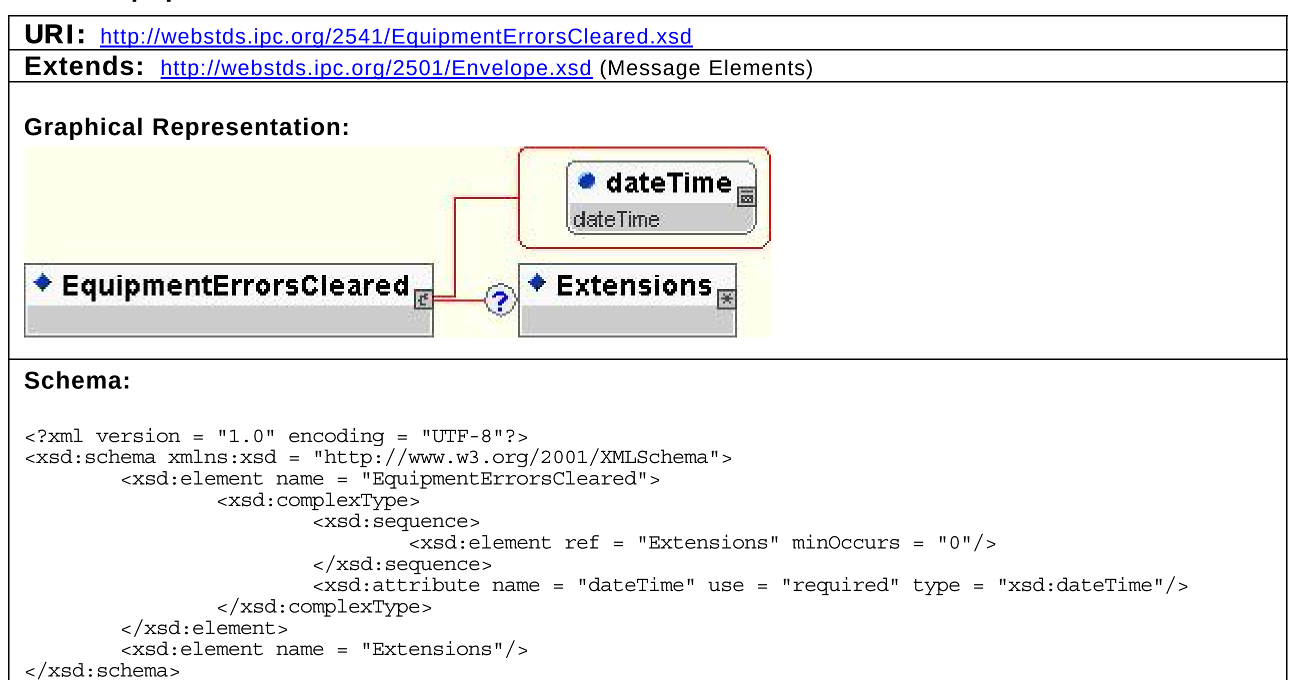
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentErrorCleared">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "errorInstanceId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.9 EquipmentErrorsCleared



URI: http://webstds.ipc.org/2541/EquipmentErrorsCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

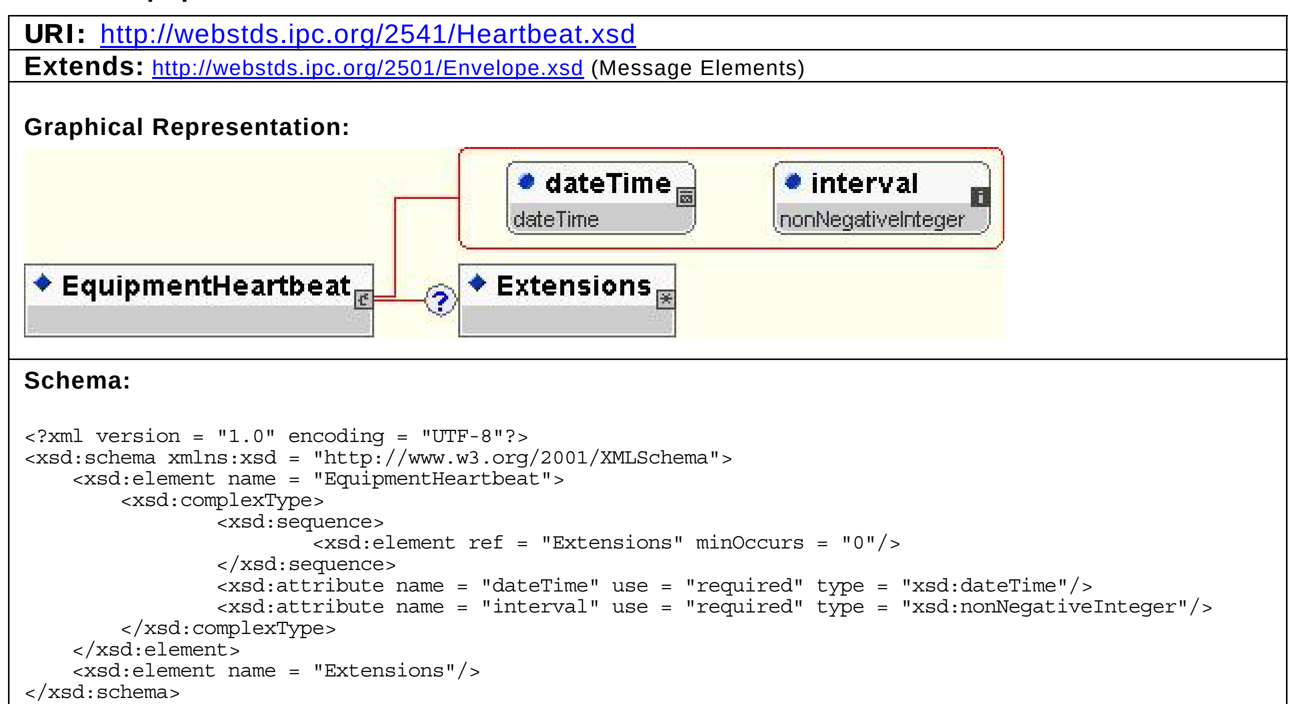
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentErrorsCleared">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.10 EquipmentHeartbeat

URI: http://webstds.ipc.org/2541/Heartbeat.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

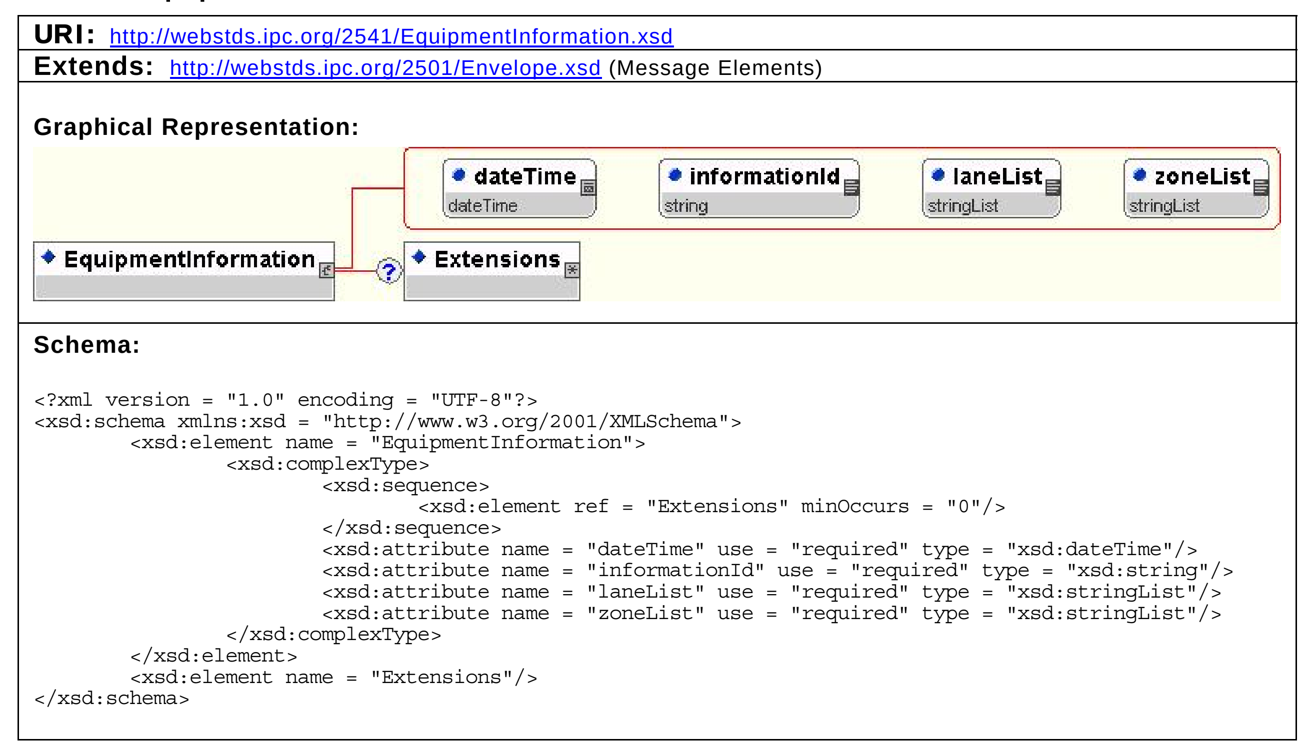
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentHeartbeat">
        <xsd:complexType>
                <xsd:sequence>
                        <xsd:element ref = "Extensions" minOccurs = "0"/>
                </xsd:sequence>
                <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                <xsd:attribute name = "interval" use = "required" type = "xsd:nonNegativeInteger"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.11 EquipmentInformation

URI: http://webstds.ipc.org/2541/EquipmentInformation.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

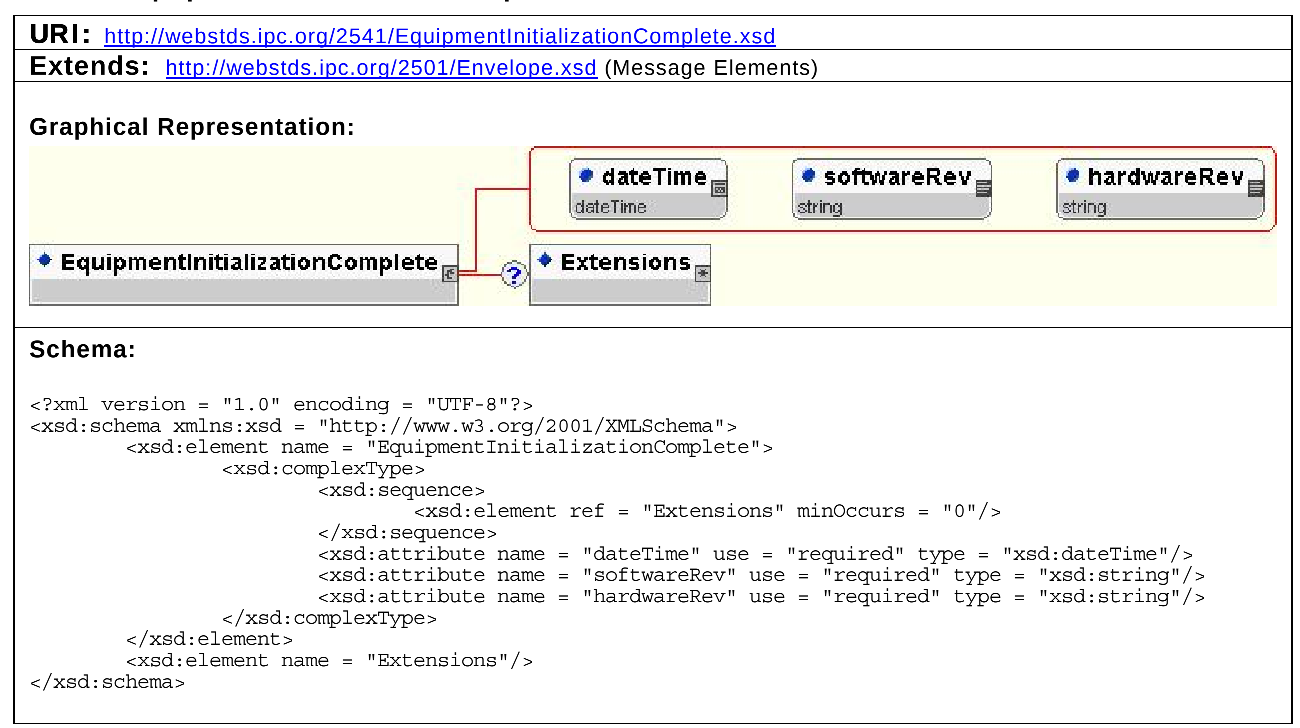
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentInformation">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "informationId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
                        <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.12 EquipmentInitializationComplete

URI: http://webstds.ipc.org/2541/EquipmentInitializationComplete.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

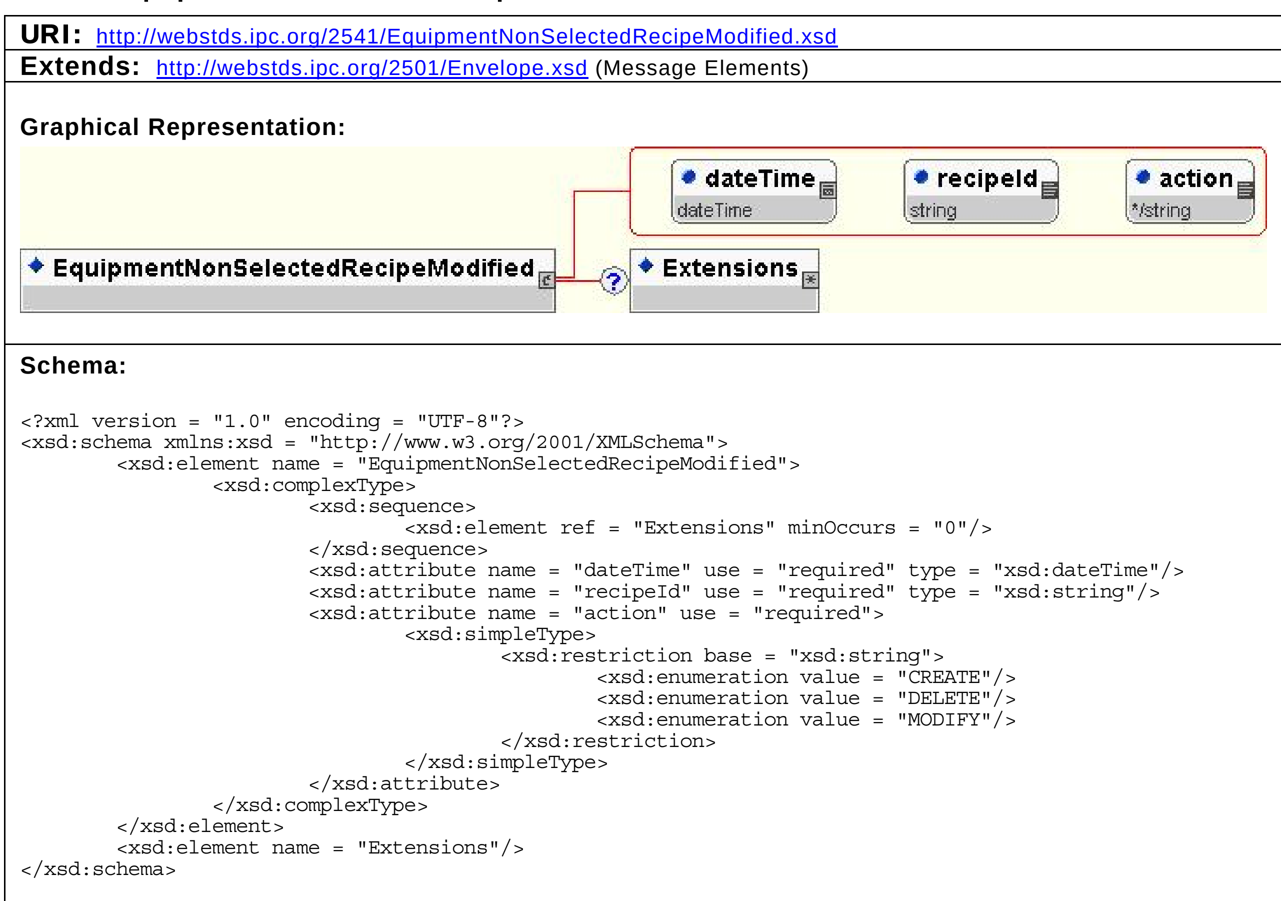
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentInitializationComplete">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "softwareRev" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "hardwareRev" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.13 EquipmentNonSelectedRecipeModified



URI: http://webstds.ipc.org/2541/EquipmentNonSelectedRecipeModified.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

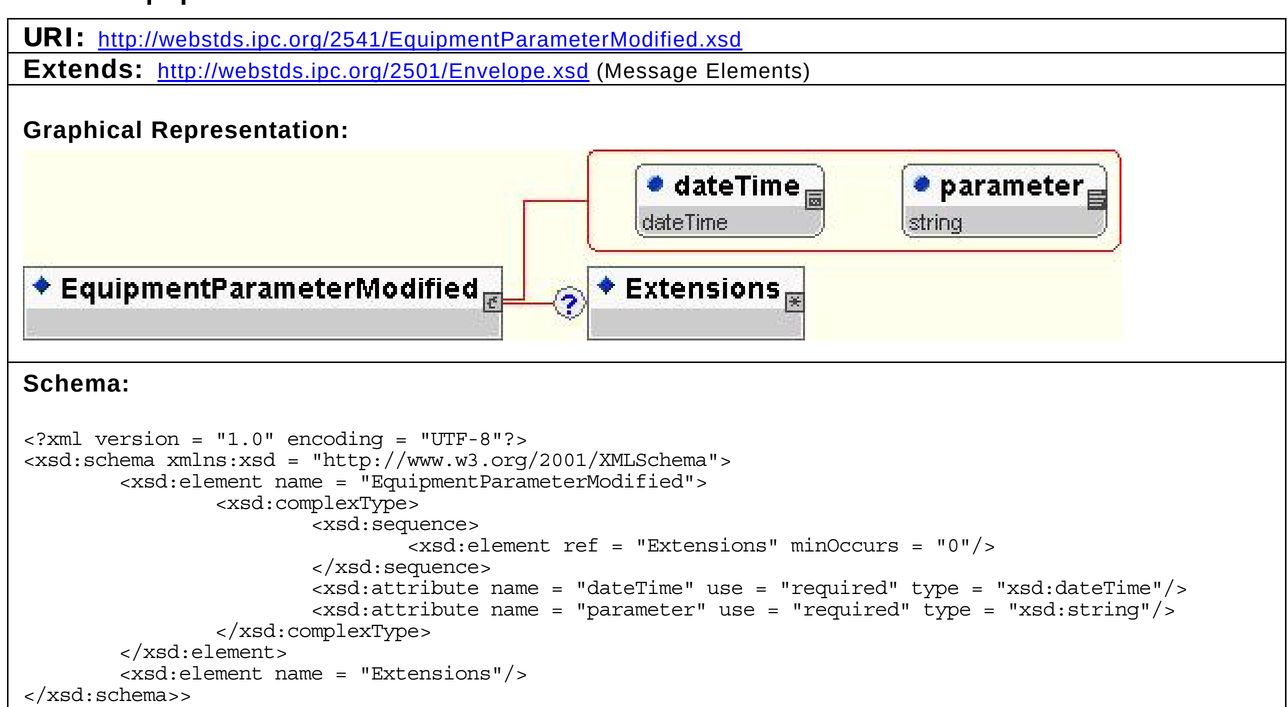
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentNonSelectedRecipeModified">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "action" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "CREATE"/>
                                                <xsd:enumeration value = "DELETE"/>
                                                <xsd:enumeration value = "MODIFY"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.14 EquipmentParameterModified

URI: http://webstds.ipc.org/2541/EquipmentParameterModified.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

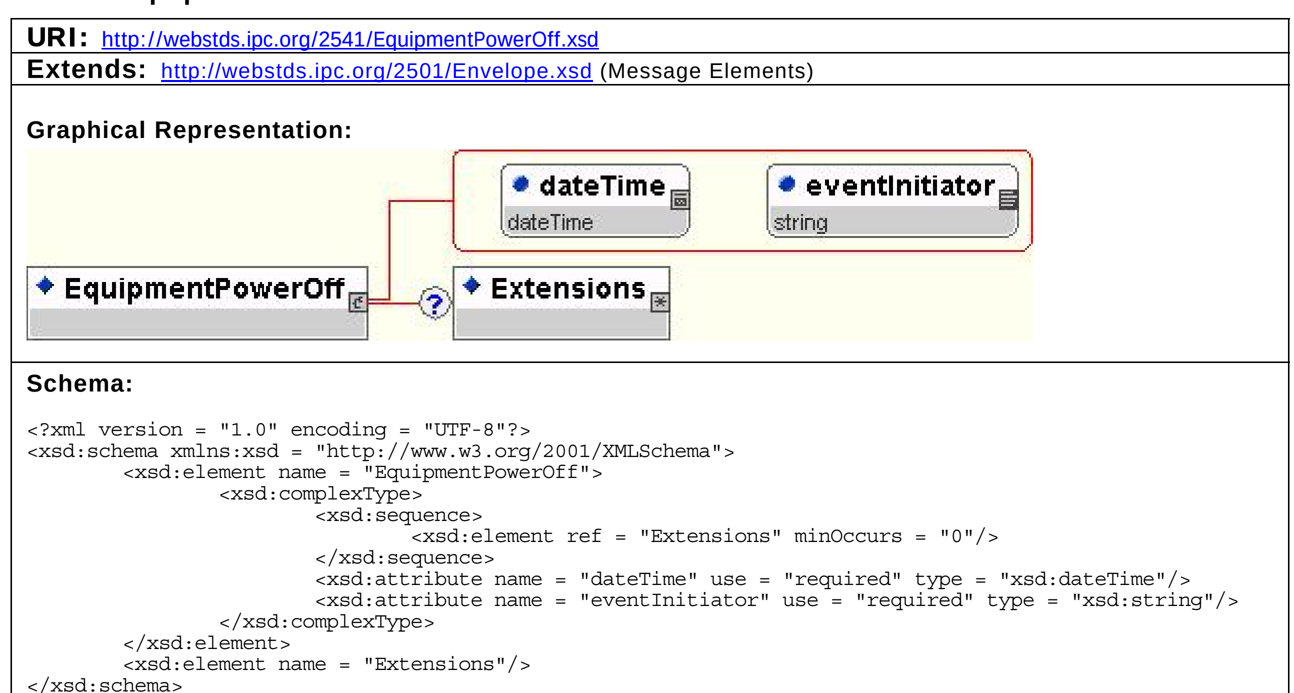
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentParameterModified">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "parameter" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>>
```

10.15 EquipmentPowerOff

URI: http://webstds.ipc.org/2541/EquipmentPowerOff.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

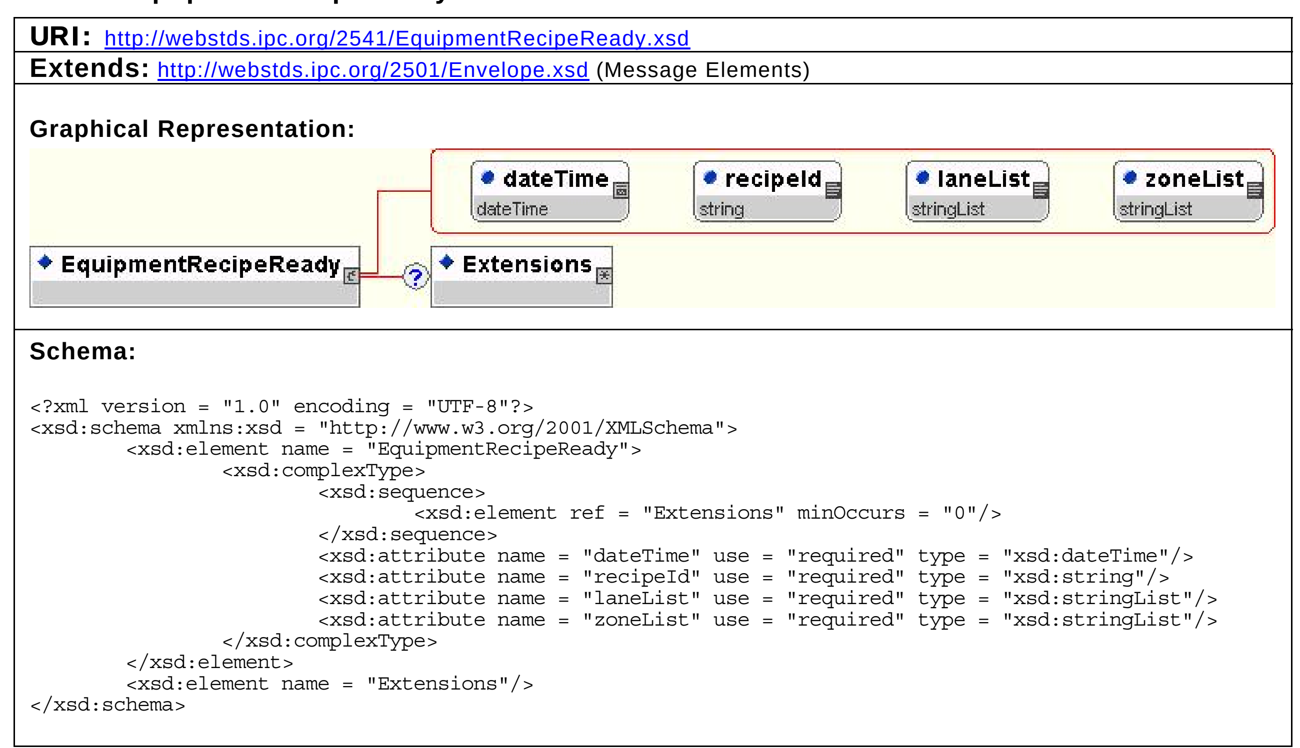
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentPowerOff">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.16 EquipmentRecipeReady

URI: http://webstds.ipc.org/2541/EquipmentRecipeReady.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

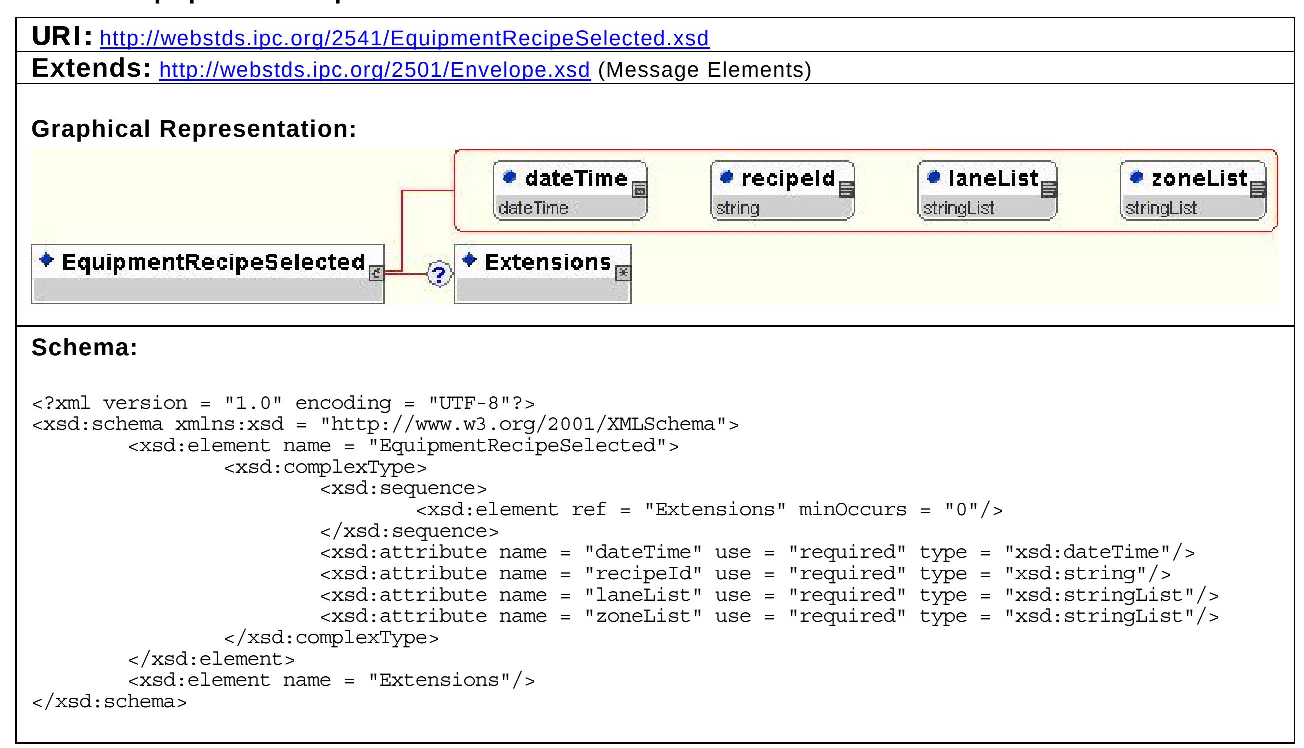
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentRecipeReady">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
                        <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.17 EquipmentRecipeSelected

URI: http://webstds.ipc.org/2541/EquipmentRecipeSelected.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

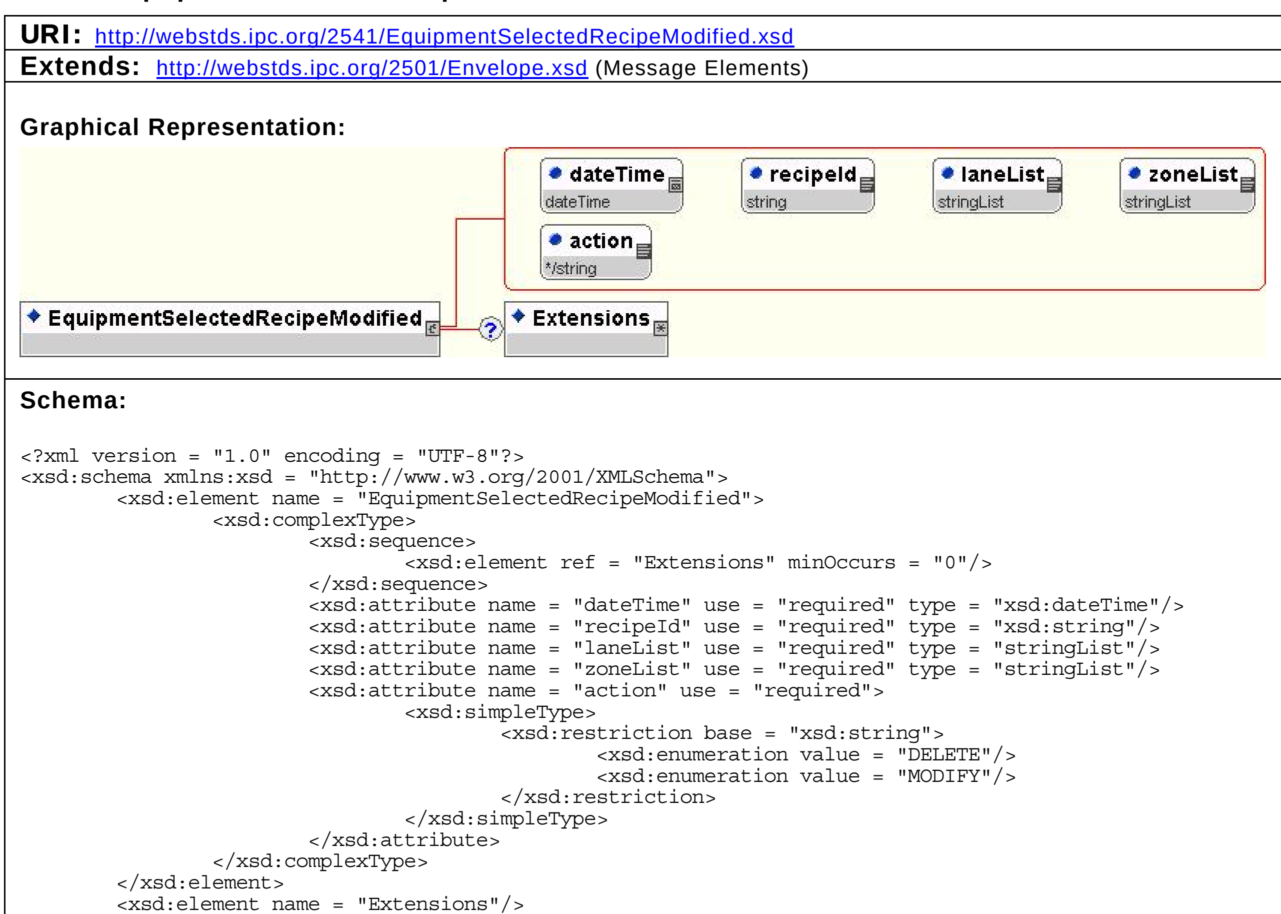
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentRecipeSelected">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
                        <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.18 EquipmentSelectedRecipeModified

URI: http://webstds.ipc.org/2541/EquipmentSelectedRecipeModified.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

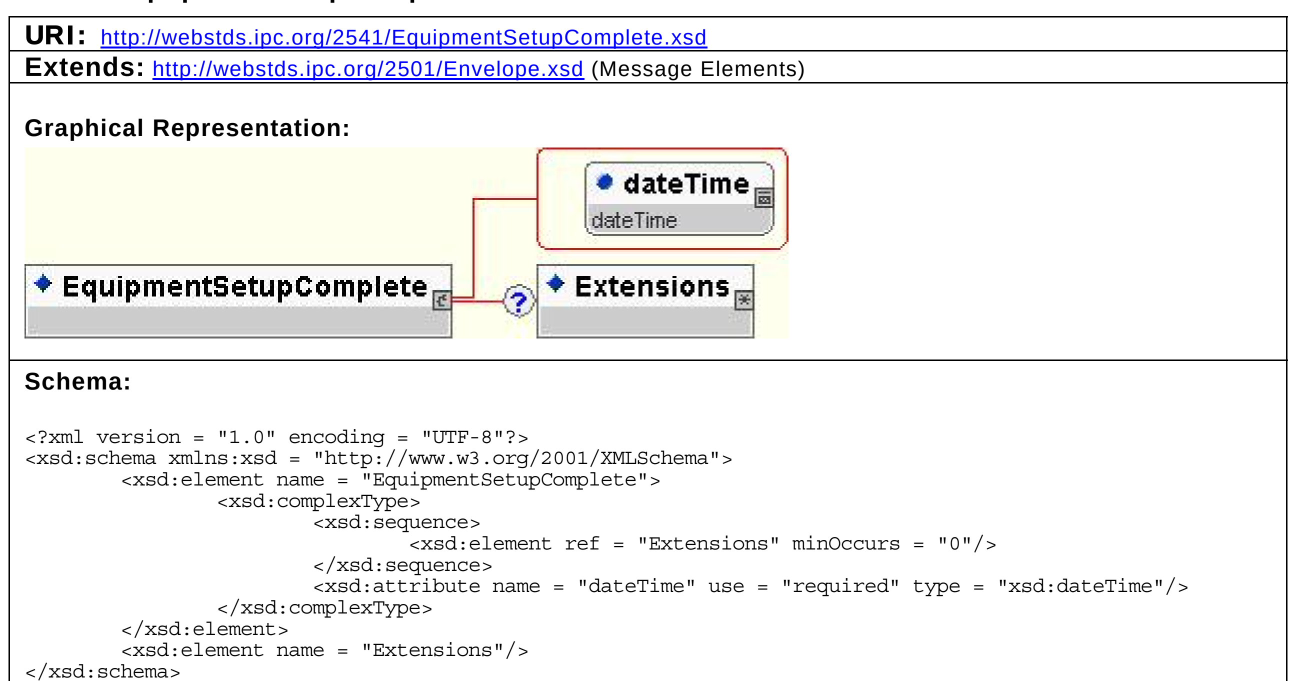
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "EquipmentSelectedRecipeModified">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "laneList" use = "required" type = "stringList"/>
			<xsd:attribute name = "zoneList" use = "required" type = "stringList"/>
			<xsd:attribute name = "action" use = "required">
				<xsd:simpleType>
					<xsd:restriction base = "xsd:string">
						<xsd:enumeration value = "DELETE"/>
						<xsd:enumeration value = "MODIFY"/>
					</xsd:restriction>
				</xsd:simpleType>
			</xsd:attribute>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.19 EquipmentSetupComplete

URI: http://webstds.ipc.org/2541/EquipmentSetupComplete.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

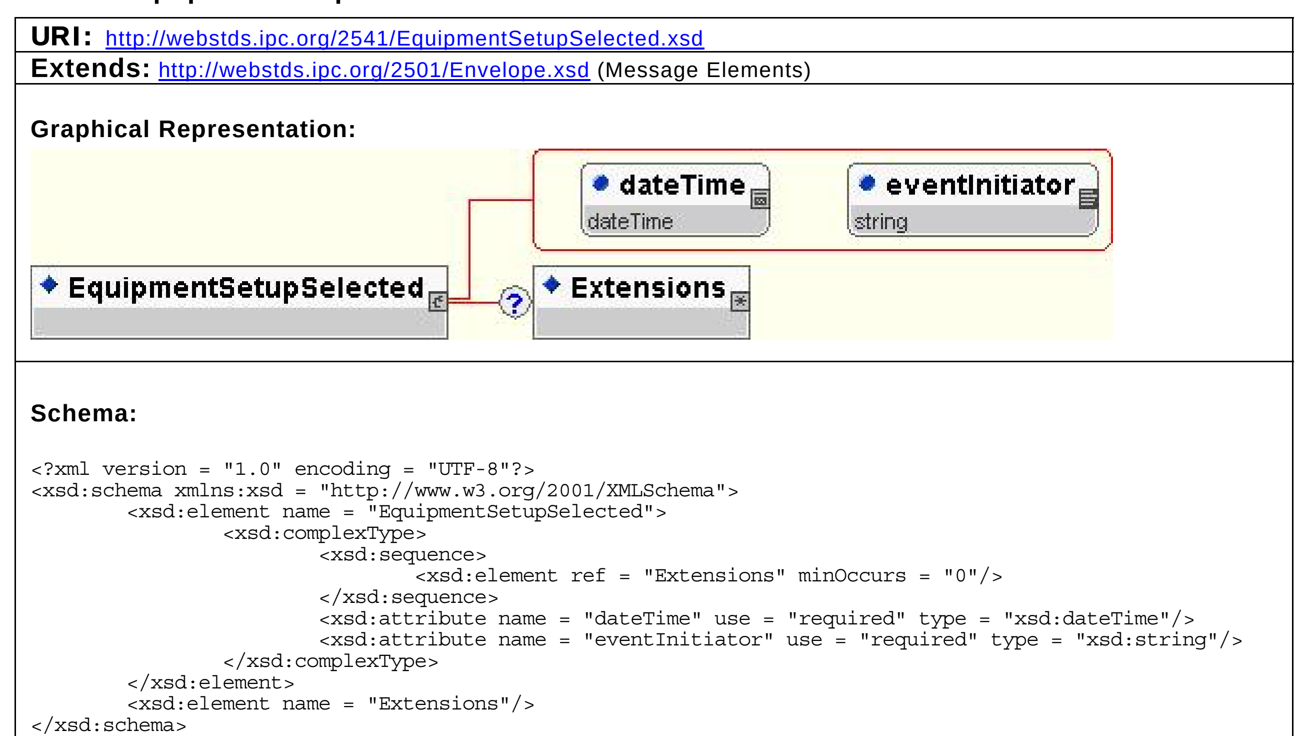
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentSetupComplete">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.20 EquipmentSetupSelected

URI: http://webstds.ipc.org/2541/EquipmentSetupSelected.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

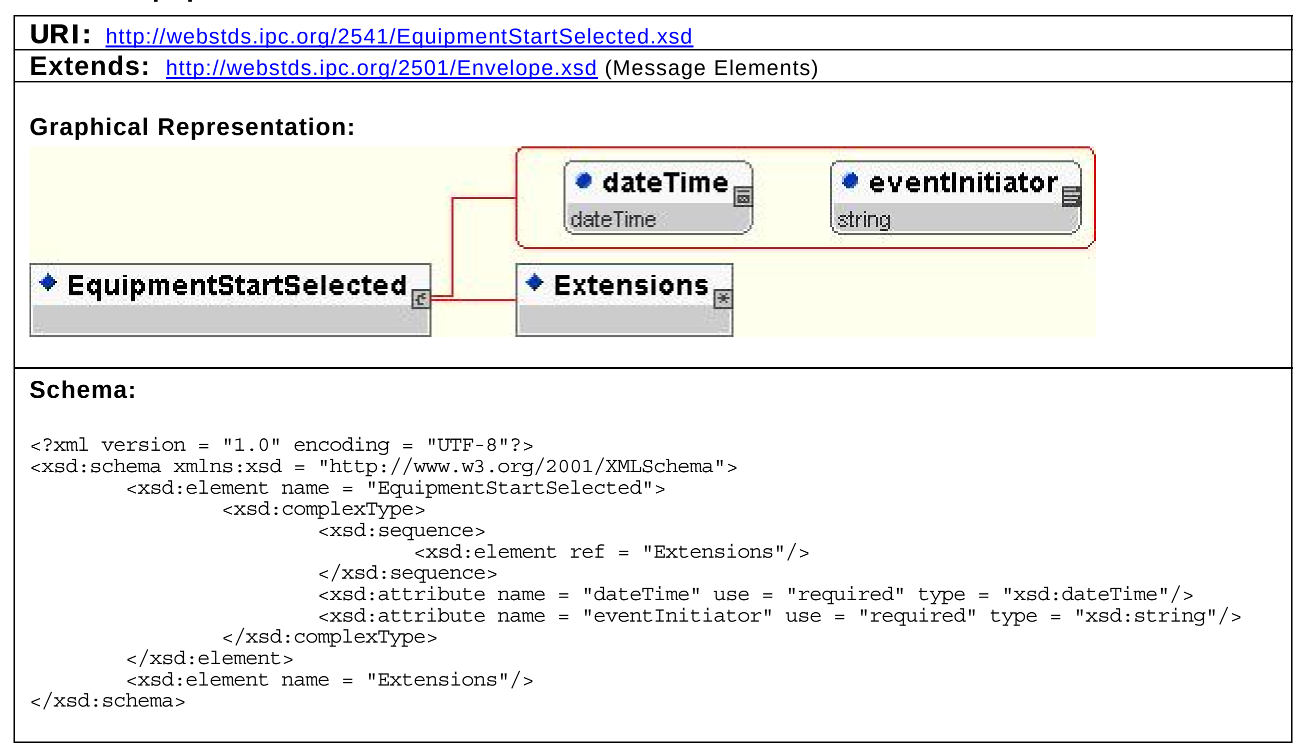
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentSetupSelected">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.21 EquipmentStartSelected

URI: http://webstds.ipc.org/2541/EquipmentStartSelected.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentStartSelected">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "eventInitiator" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.22 EquipmentStarved

URI: http://webstds.ipc.org/2541/EquipmentStarved.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

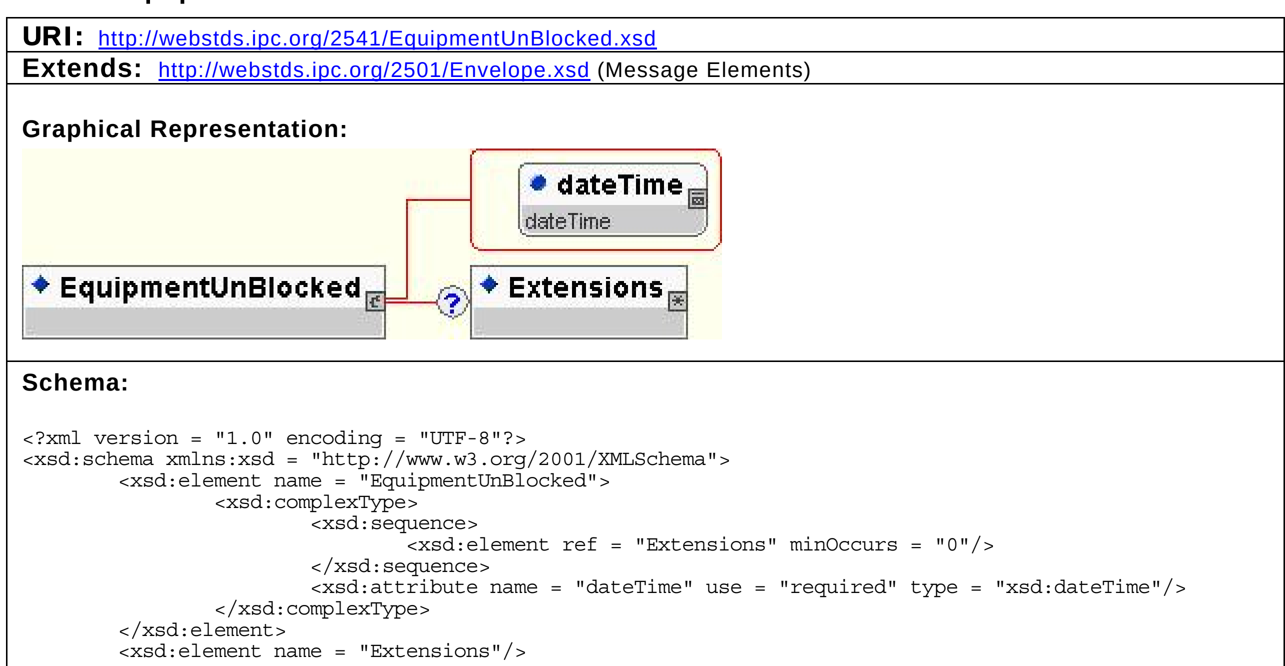
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentStarved">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.23 EquipmentUnBlocked

URI: http://webstds.ipc.org/2541/EquipmentUnBlocked.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

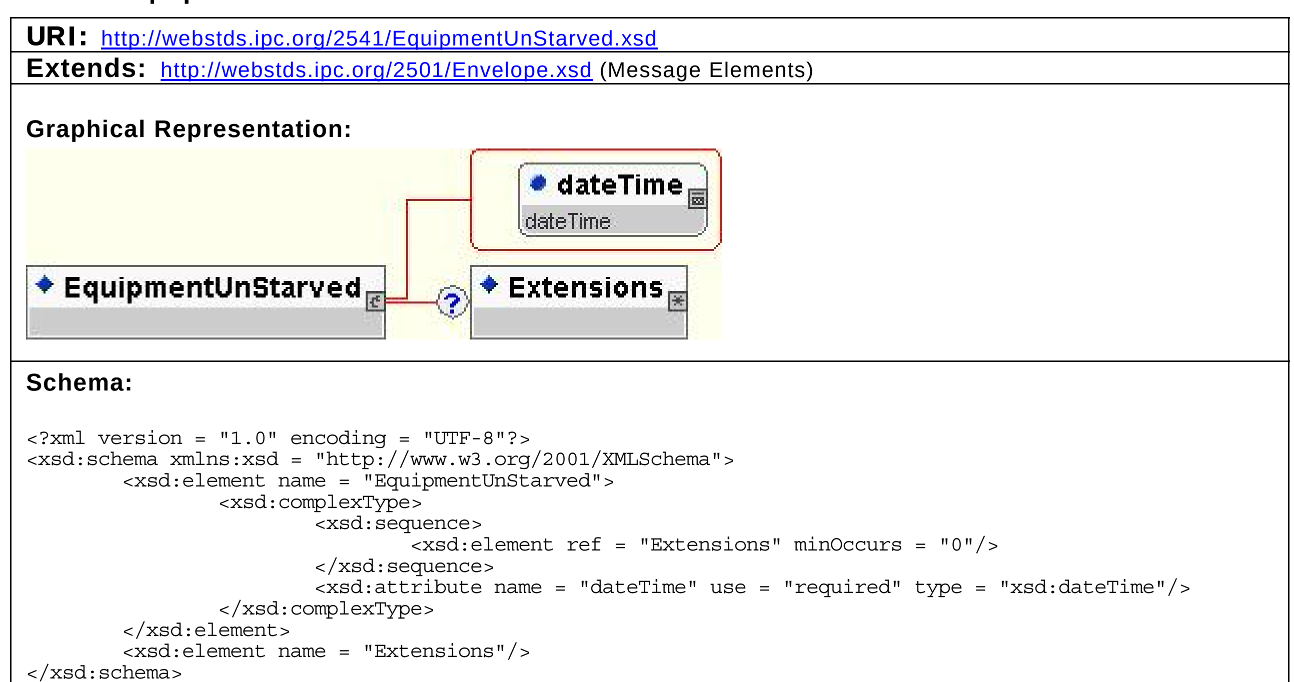
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentUnBlocked">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.24 EquipmentUnStarved

URI: http://webstds.ipc.org/2541/EquipmentUnStarved.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

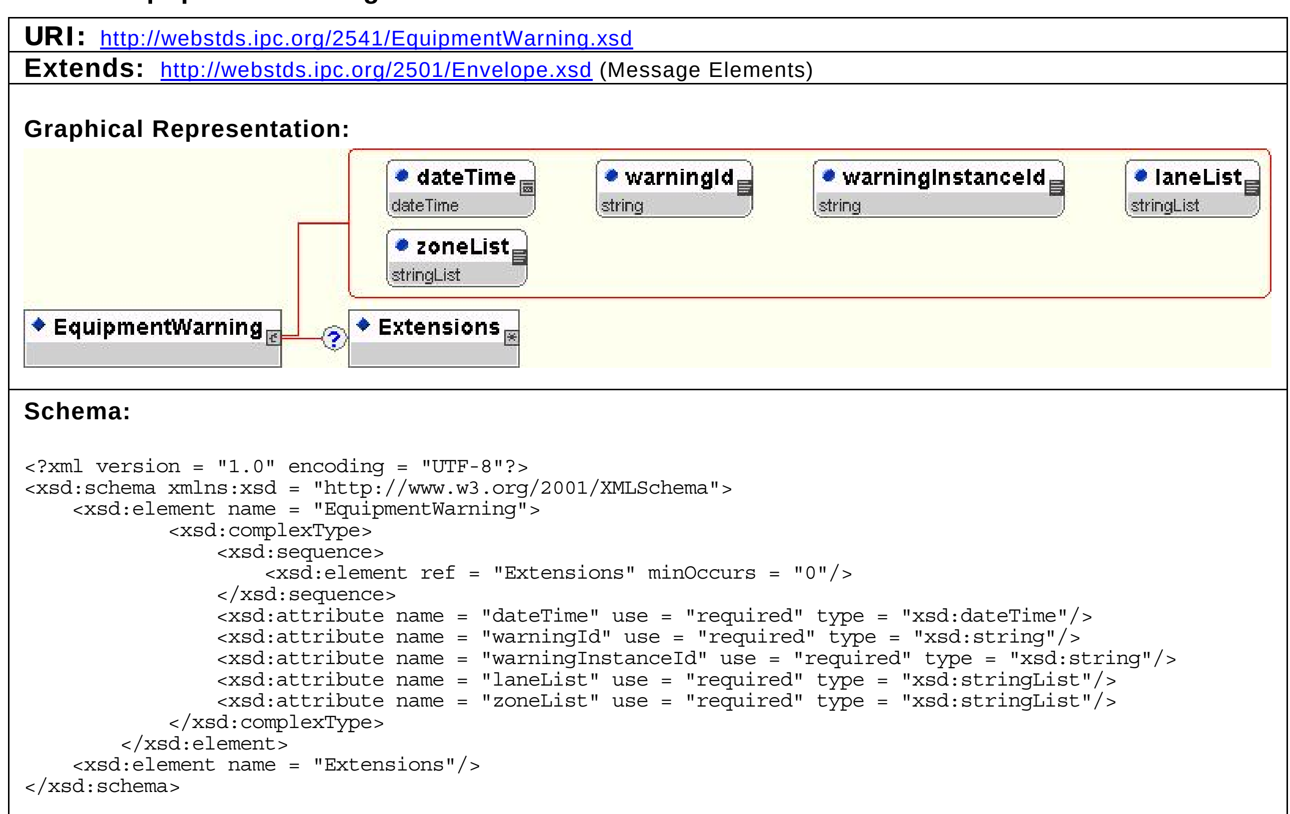
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "EquipmentUnStarved">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.25 EquipmentWarning

URI: http://webstds.ipc.org/2541/EquipmentWarning.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

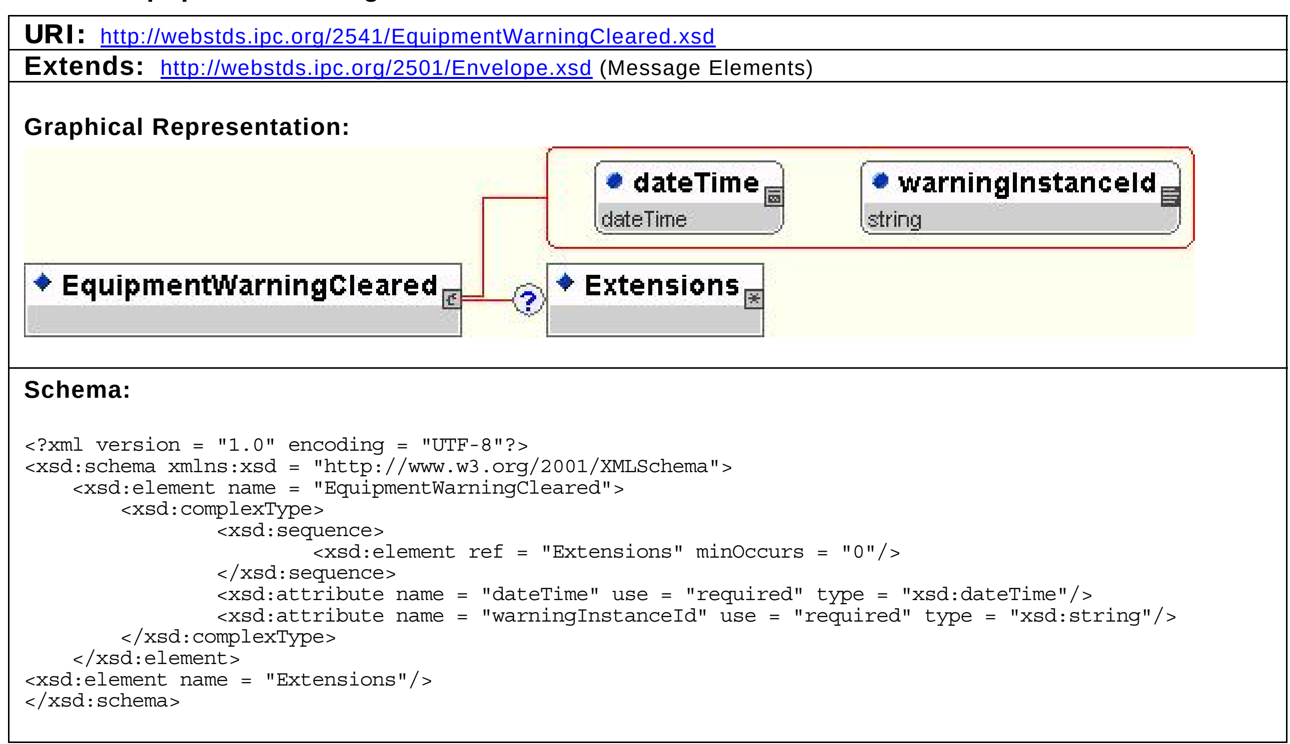
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentWarning">
            <xsd:complexType>
                <xsd:sequence>
                    <xsd:element ref = "Extensions" minOccurs = "0"/>
                </xsd:sequence>
                <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                <xsd:attribute name = "warningId" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "laneList" use = "required" type = "xsd:stringList"/>
                <xsd:attribute name = "zoneList" use = "required" type = "xsd:stringList"/>
            </xsd:complexType>
        </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.26 EquipmentWarningCleared

URI: http://webstds.ipc.org/2541/EquipmentWarningCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

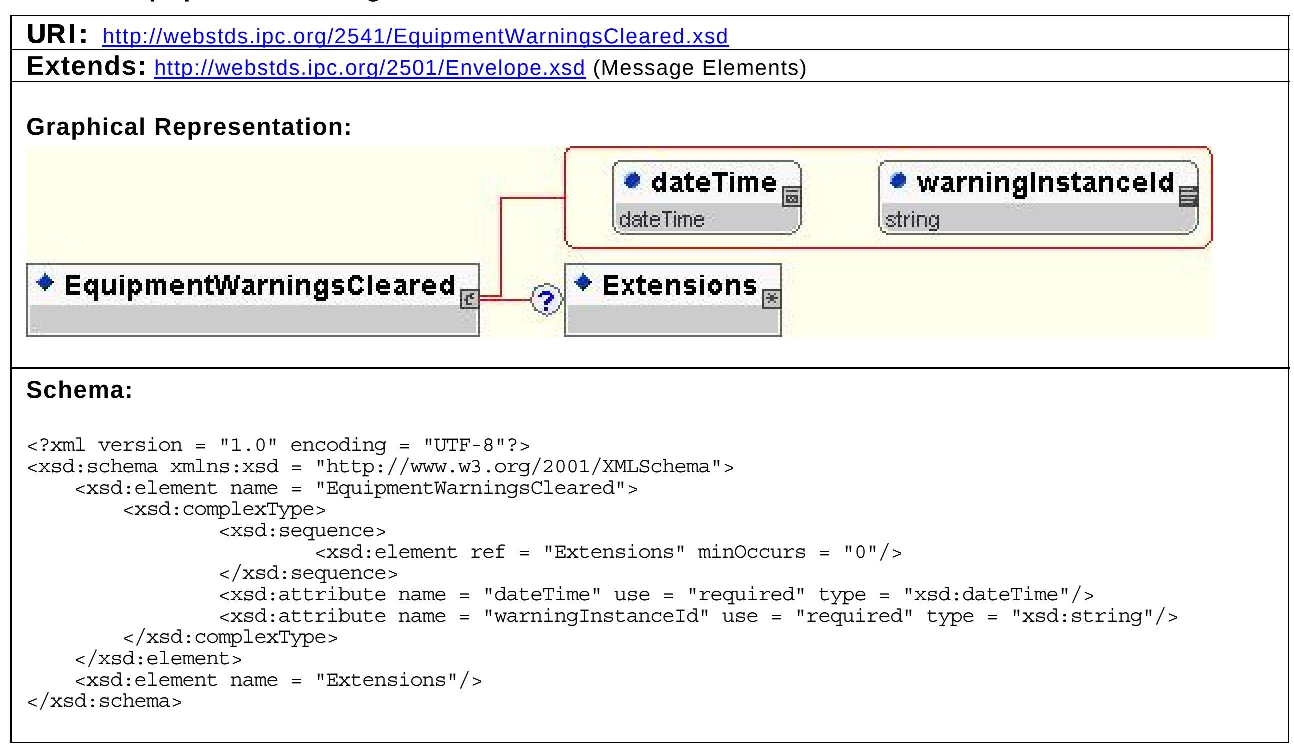
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentWarningCleared">
        <xsd:complexType>
                <xsd:sequence>
                        <xsd:element ref = "Extensions" minOccurs = "0"/>
                </xsd:sequence>
                <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.27 EquipmentWarningsCleared

URI: http://webstds.ipc.org/2541/EquipmentWarningsCleared.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

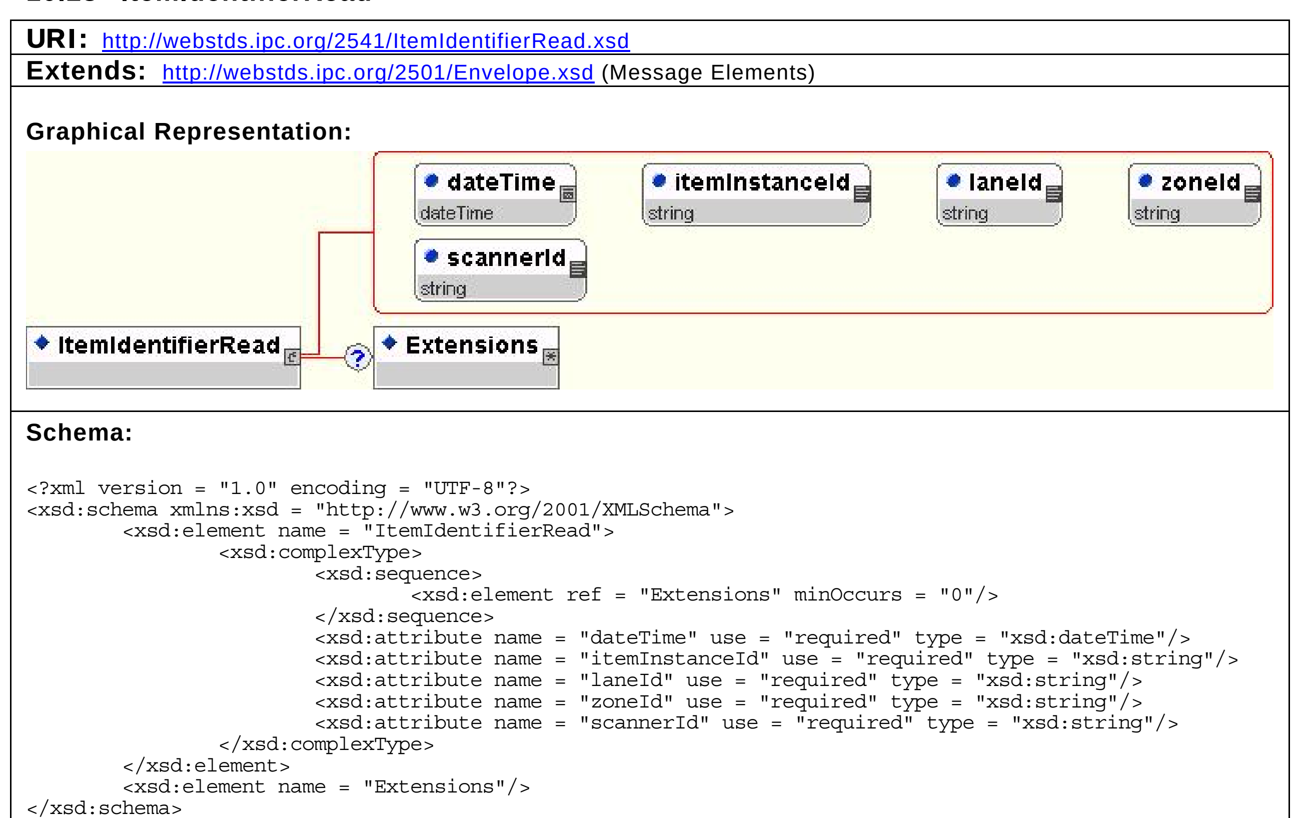
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
    <xsd:element name = "EquipmentWarningsCleared">
        <xsd:complexType>
                <xsd:sequence>
                        <xsd:element ref = "Extensions" minOccurs = "0"/>
                </xsd:sequence>
                <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                <xsd:attribute name = "warningInstanceId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.28 ItemIdentifierRead

URI: http://webstds.ipc.org/2541/ItemIdentifierRead.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

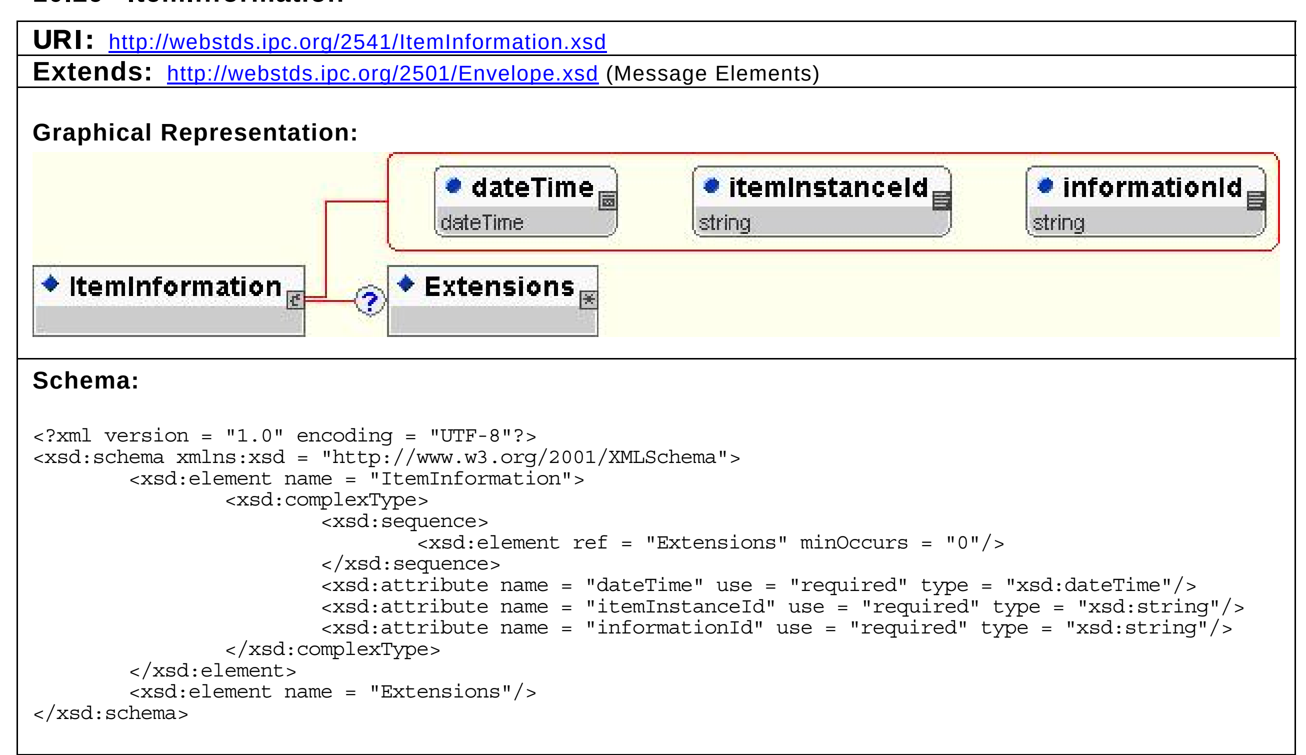
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemIdentifierRead">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "scannerId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.29 ItemInformation

URI: http://webstds.ipc.org/2541/ItemInformation.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

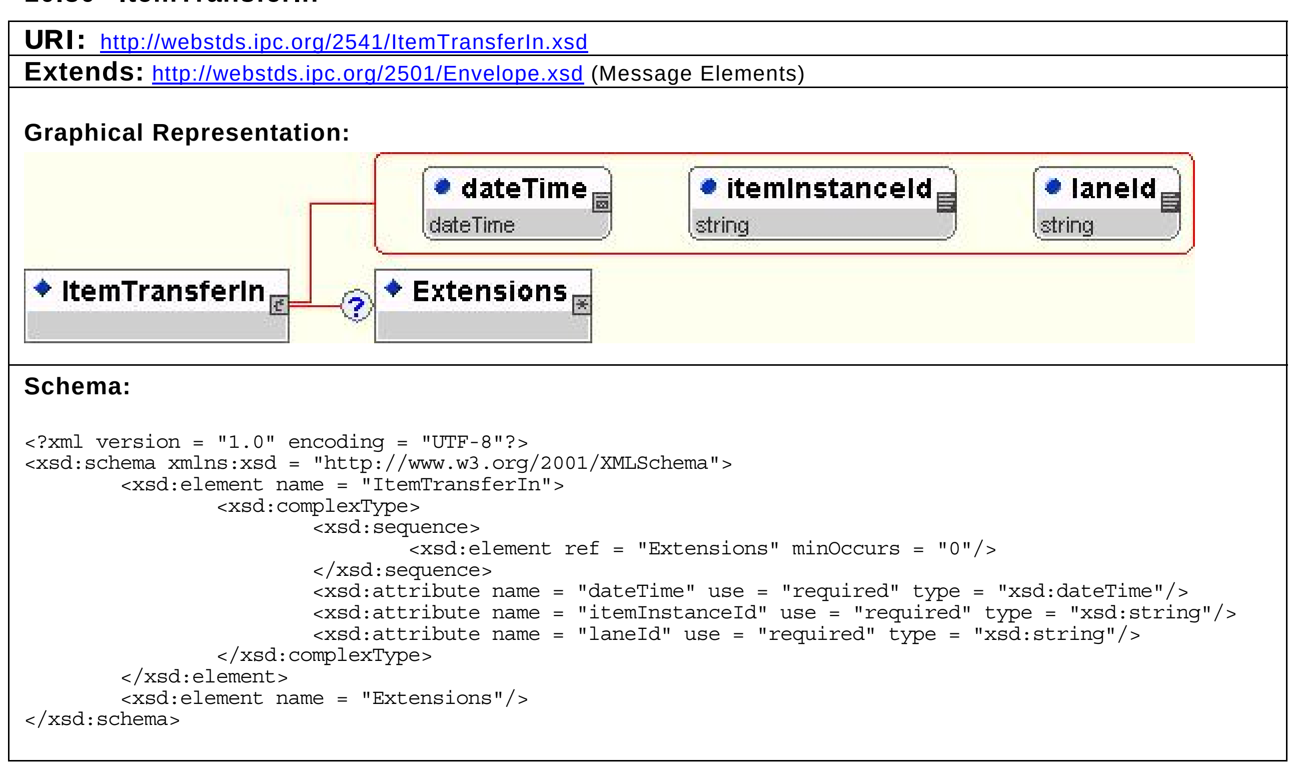
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "ItemInformation">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "informationId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.30 ItemTransferIn

URI: http://webstds.ipc.org/2541/ItemTransferIn.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

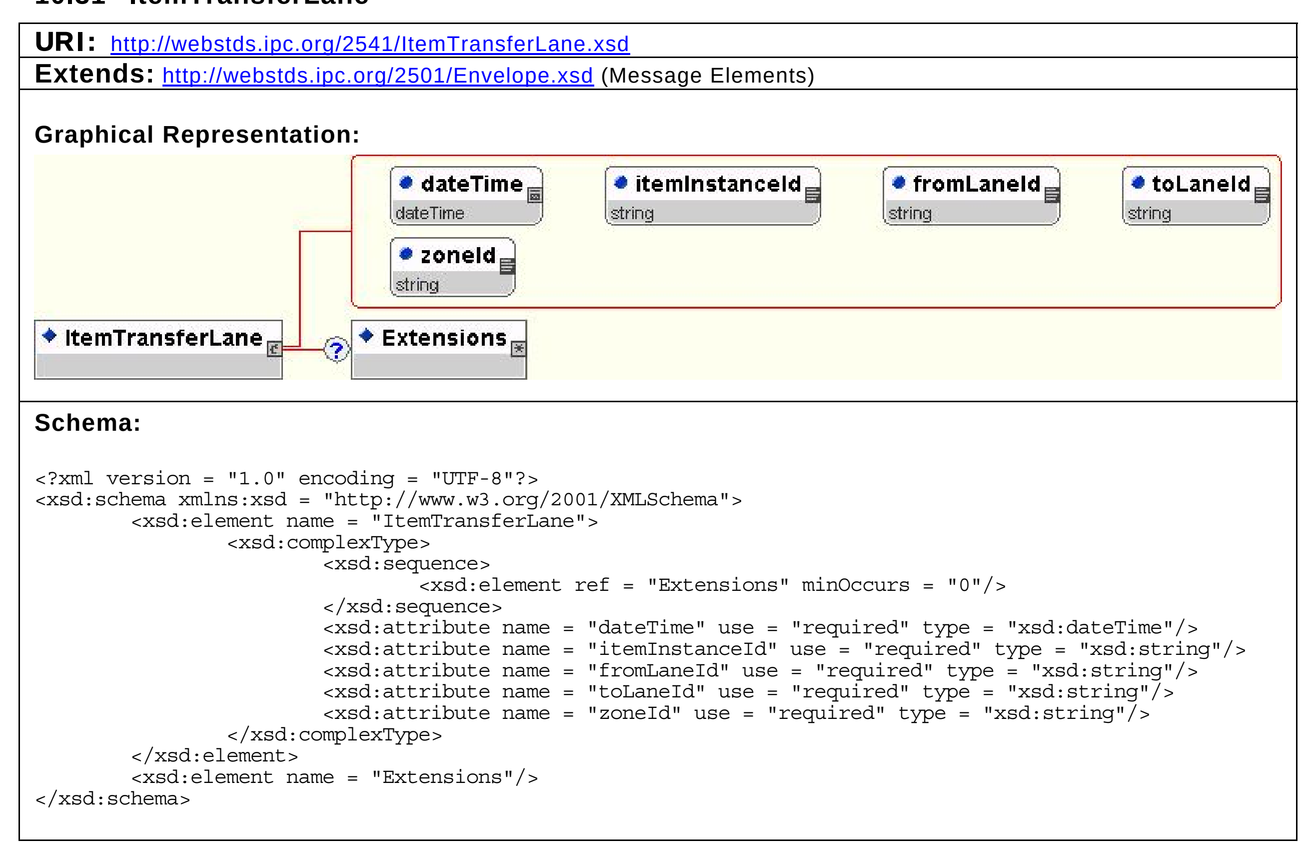
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemTransferIn">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.31 ItemTransferLane

URI: http://webstds.ipc.org/2541/ItemTransferLane.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

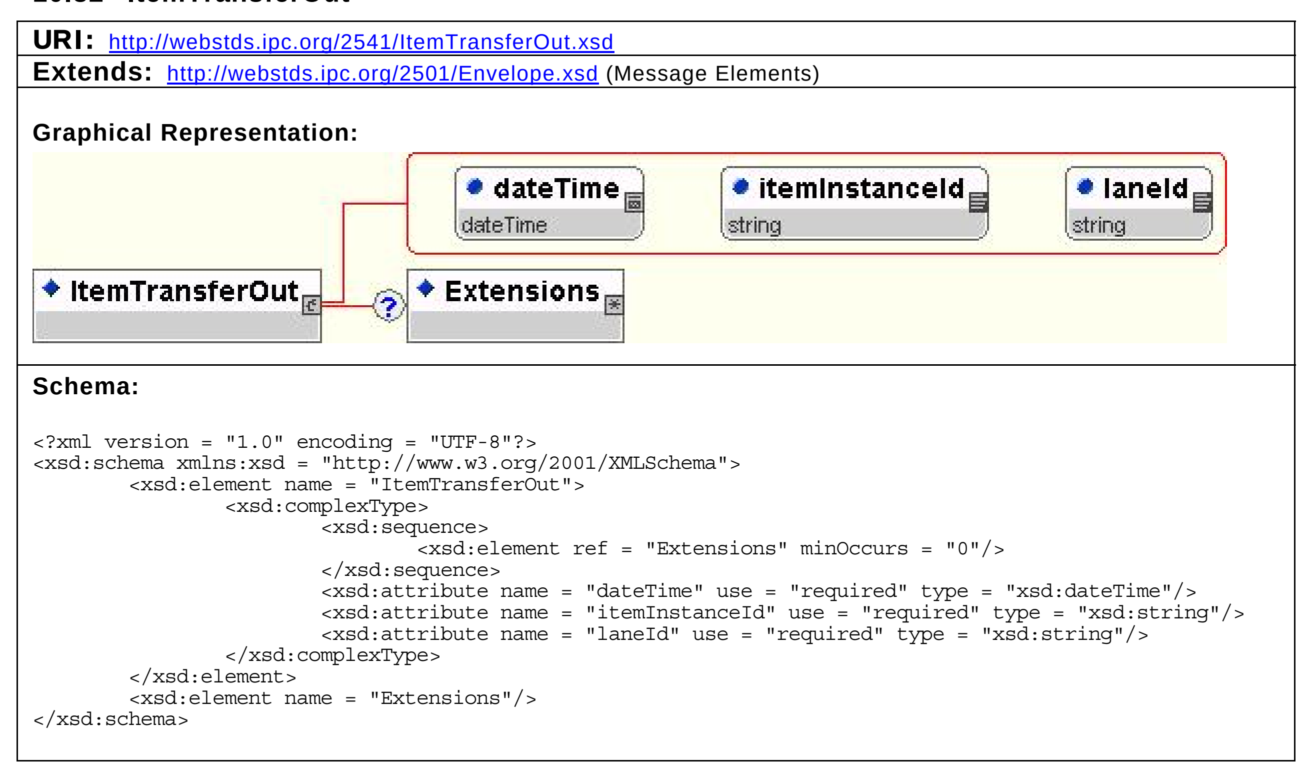
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemTransferLane">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "fromLaneId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "toLaneId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.32 ItemTransferOut



URI: http://webstds.ipc.org/2541/ItemTransferOut.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

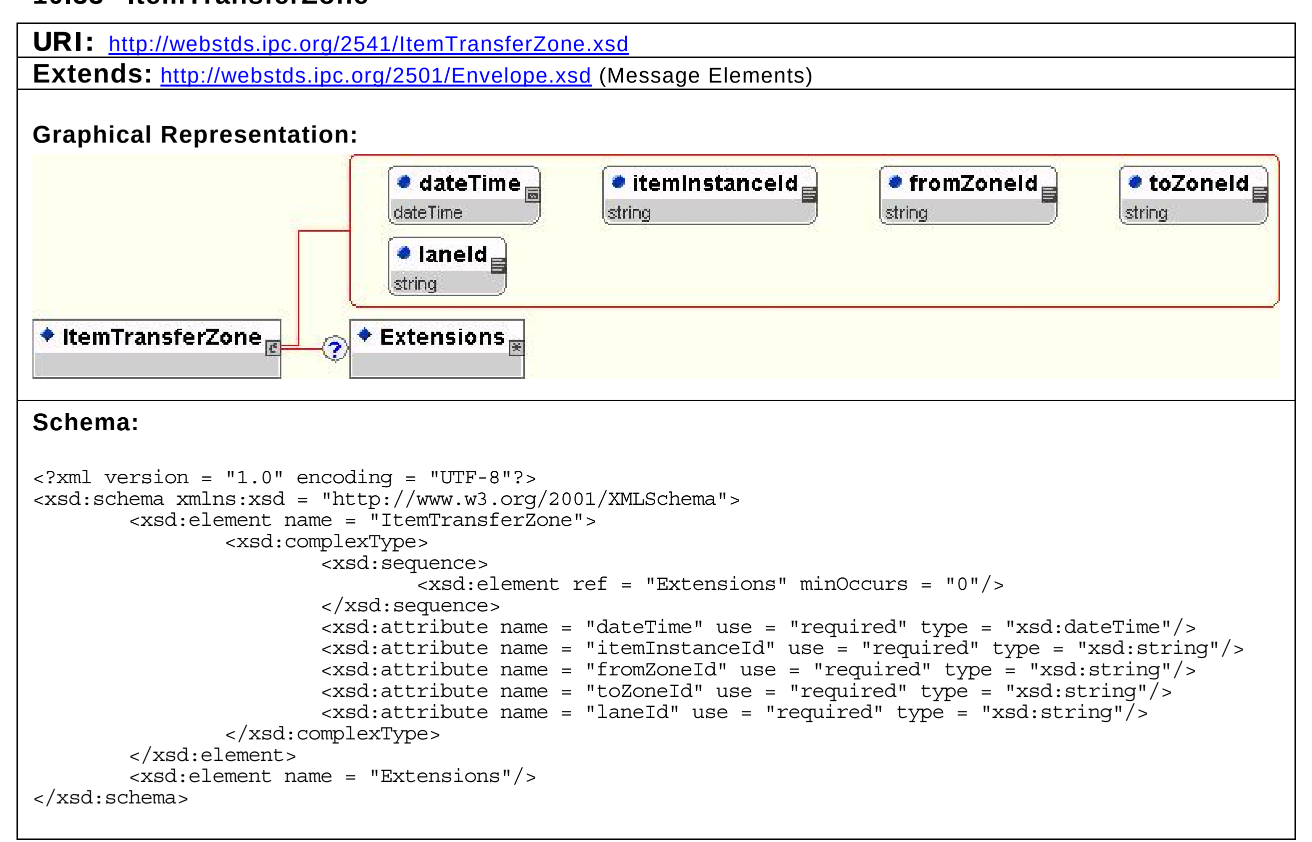
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemTransferOut">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.33 ItemTransferZone

URI: http://webstds.ipc.org/2541/ItemTransferZone.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

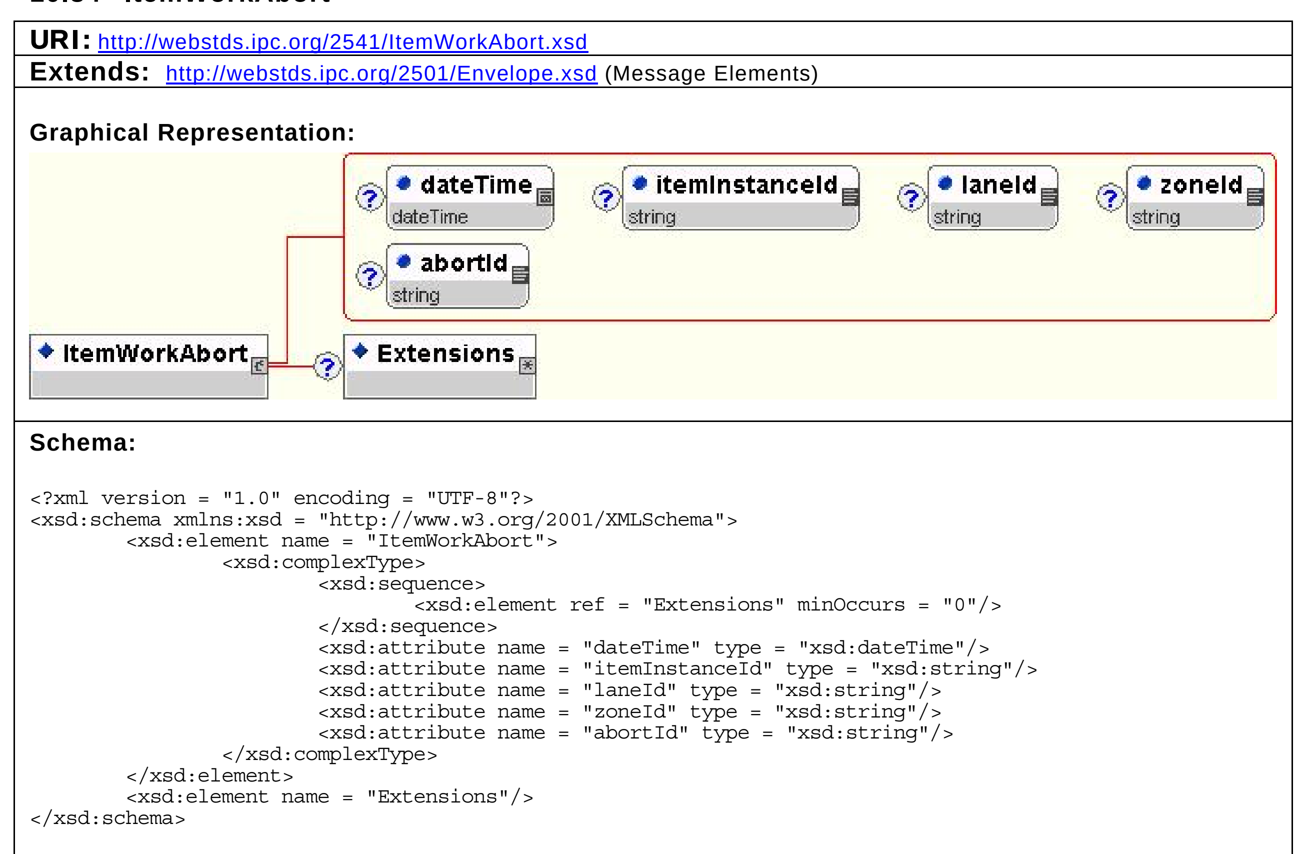
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "ItemTransferZone">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "fromZoneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "toZoneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.34 ItemWorkAbort

URI: http://webstds.ipc.org/2541/ItemWorkAbort.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

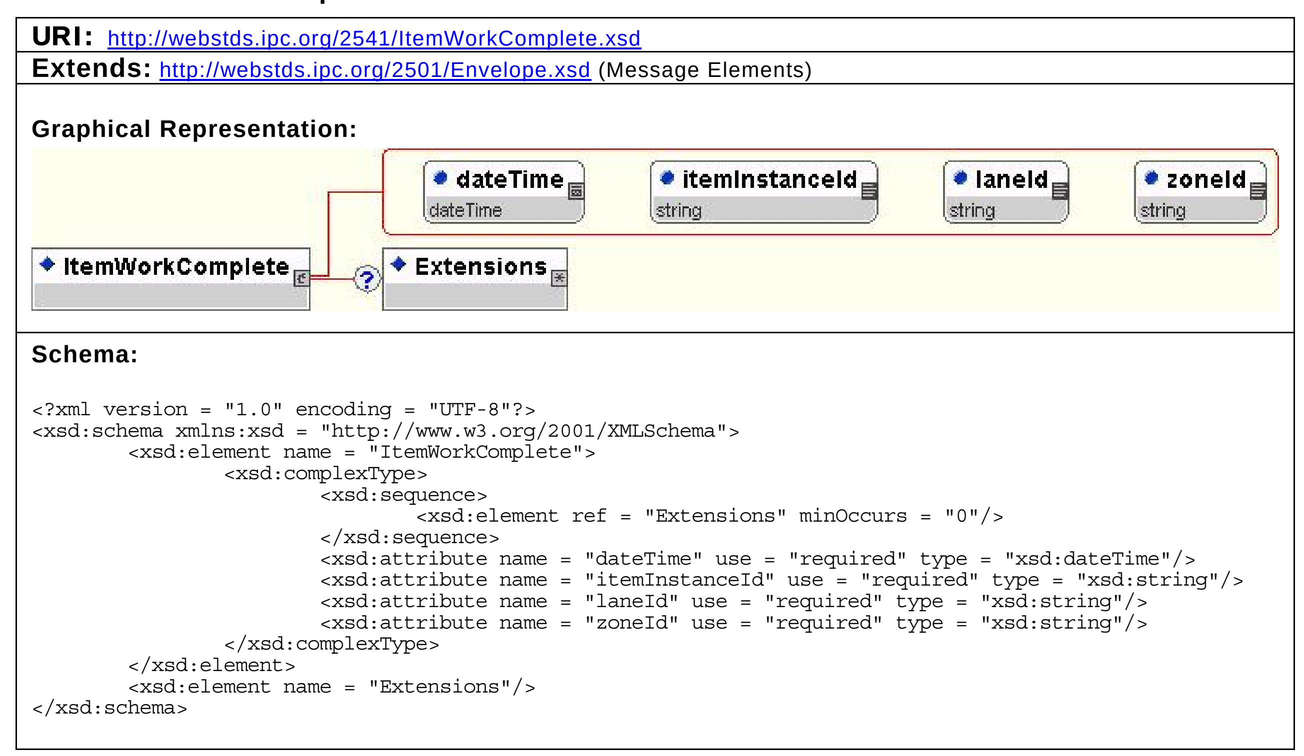
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemWorkAbort">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" type = "xsd:dateTime"/>
			<xsd:attribute name = "itemInstanceId" type = "xsd:string"/>
			<xsd:attribute name = "laneId" type = "xsd:string"/>
			<xsd:attribute name = "zoneId" type = "xsd:string"/>
			<xsd:attribute name = "abortId" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.35 ItemWorkComplete



URI: http://webstds.ipc.org/2541/ItemWorkComplete.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

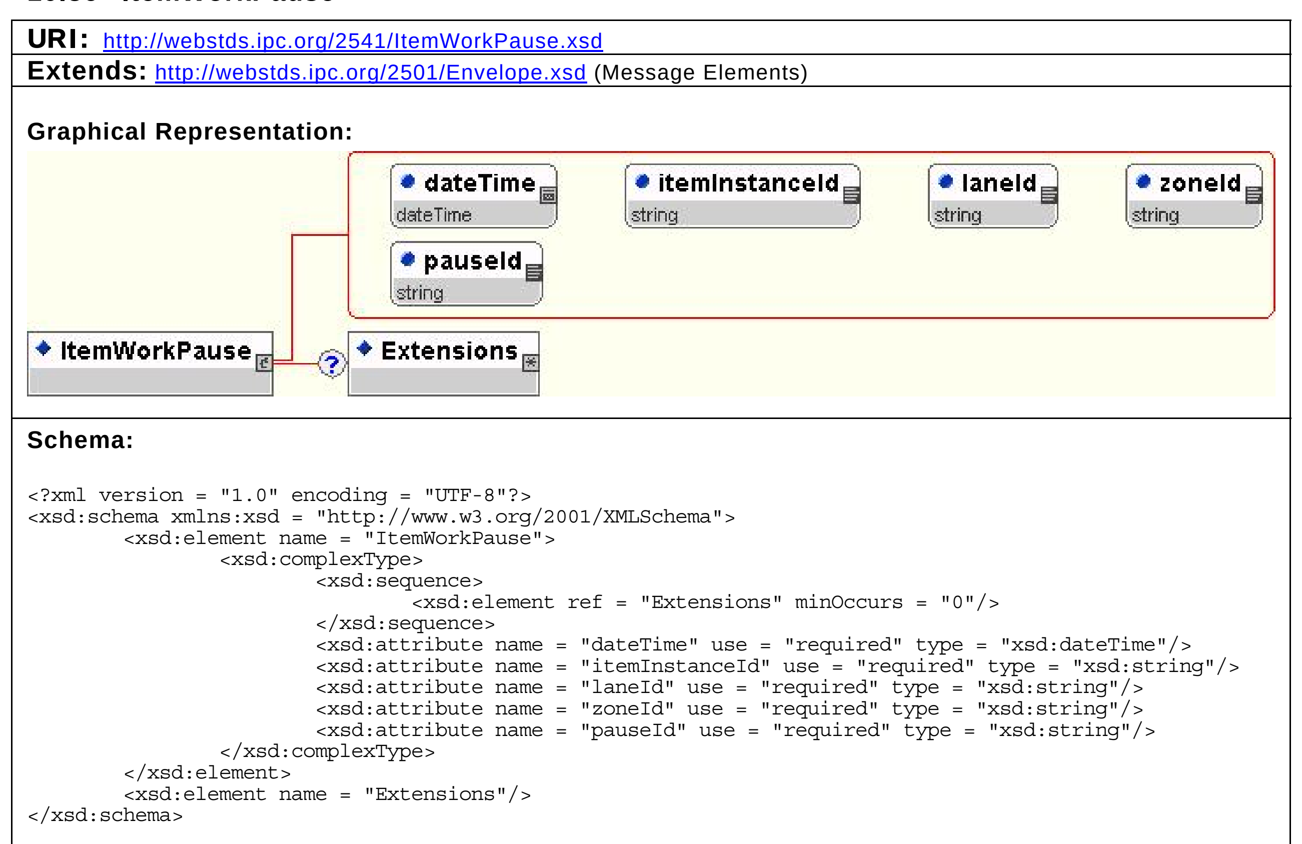
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "ItemWorkComplete">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.36 ItemWorkPause

URI: http://webstds.ipc.org/2541/ItemWorkPause.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

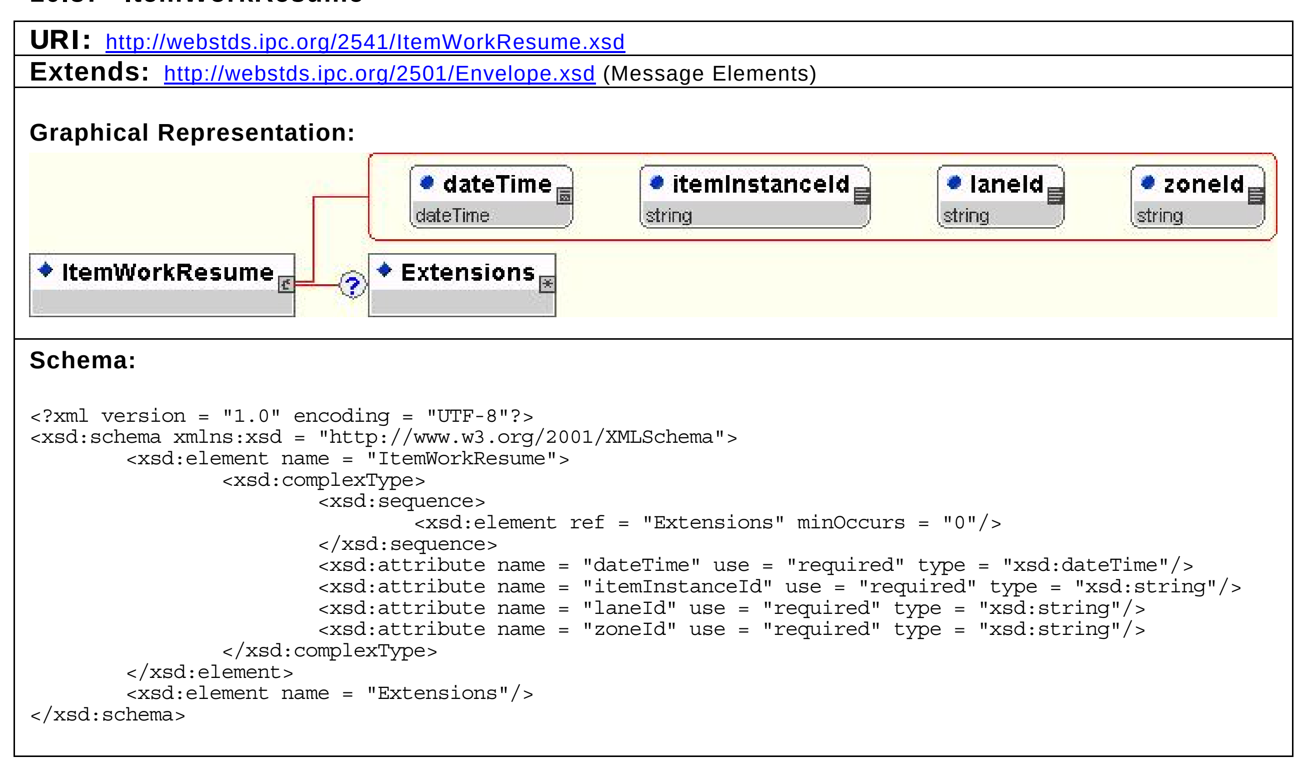
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "ItemWorkPause">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "pauseId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.37 ItemWorkResume

URI: http://webstds.ipc.org/2541/ItemWorkResume.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

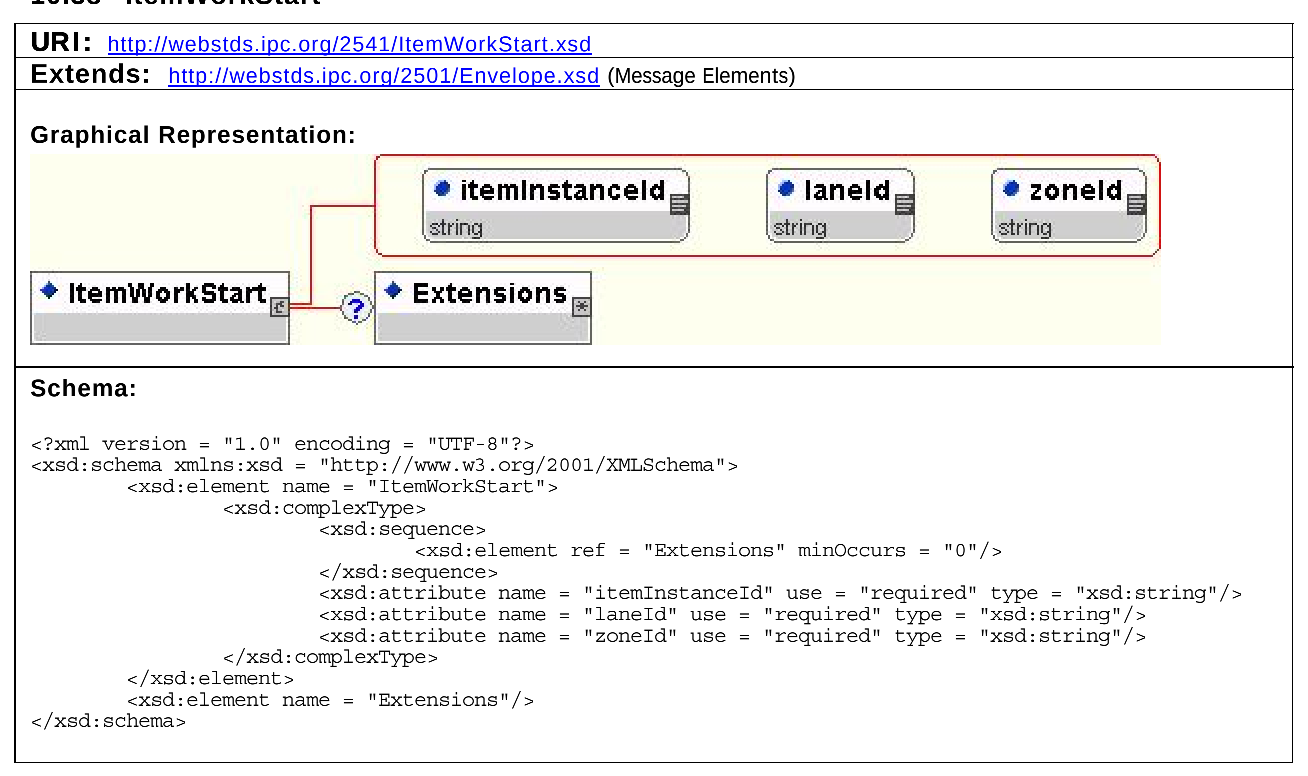
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "ItemWorkResume">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.38 ItemWorkStart



URI: http://webstds.ipc.org/2541/ItemWorkStart.xsd

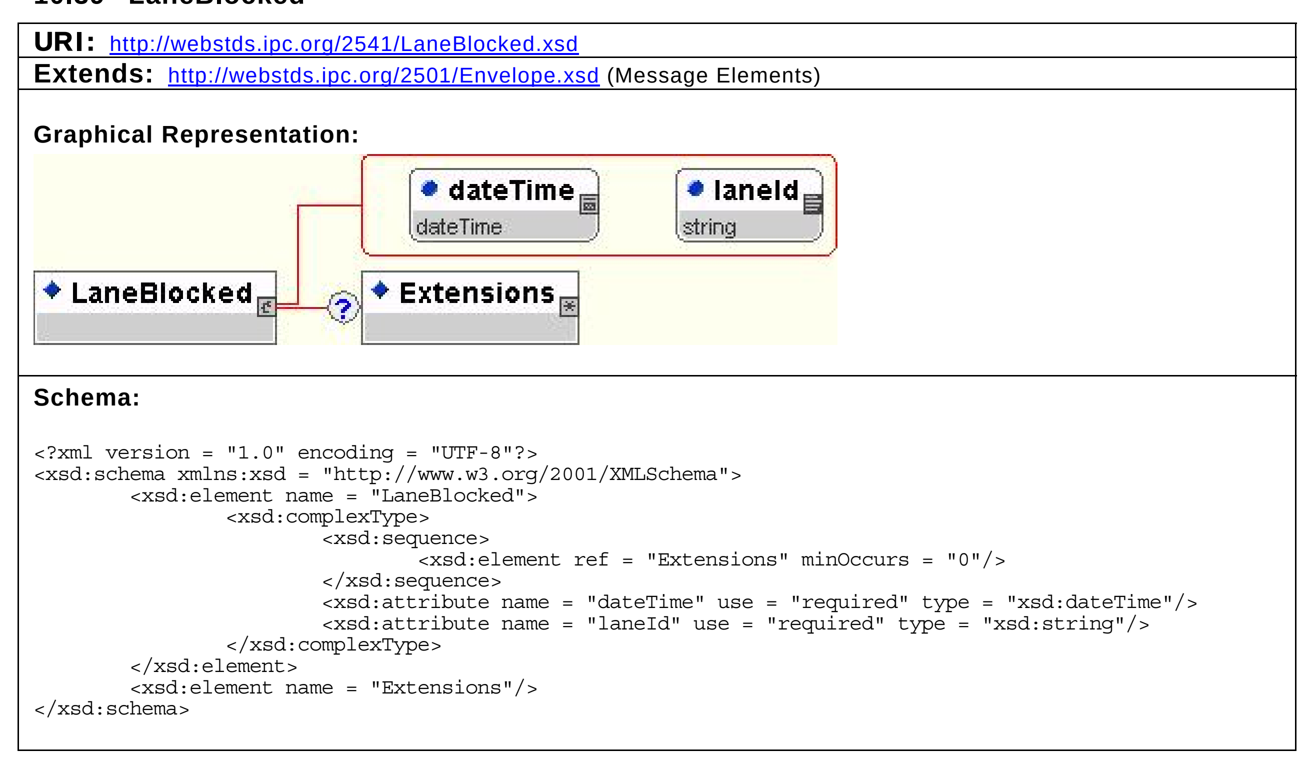
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "ItemWorkStart">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "zoneId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.39 LaneBlocked



URI: http://webstds.ipc.org/2541/LaneBlocked.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

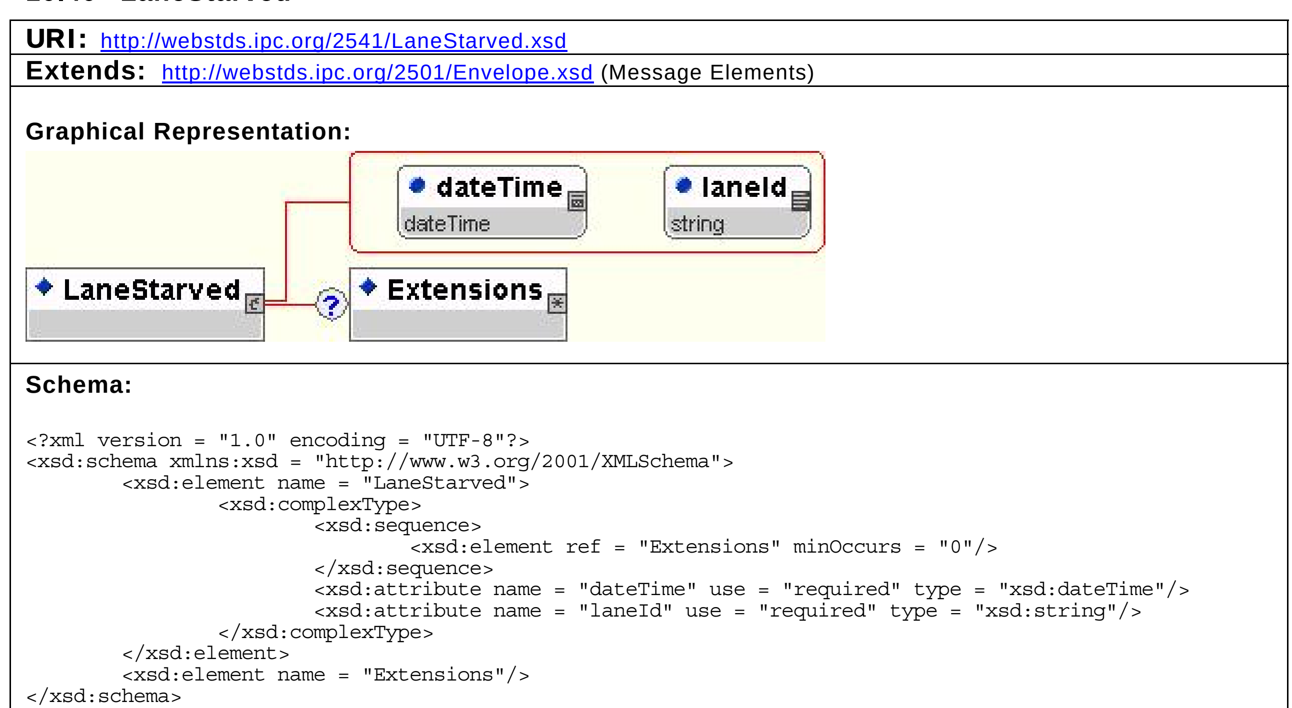
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "LaneBlocked">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.40 LaneStarved

URI: http://webstds.ipc.org/2541/LaneStarved.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

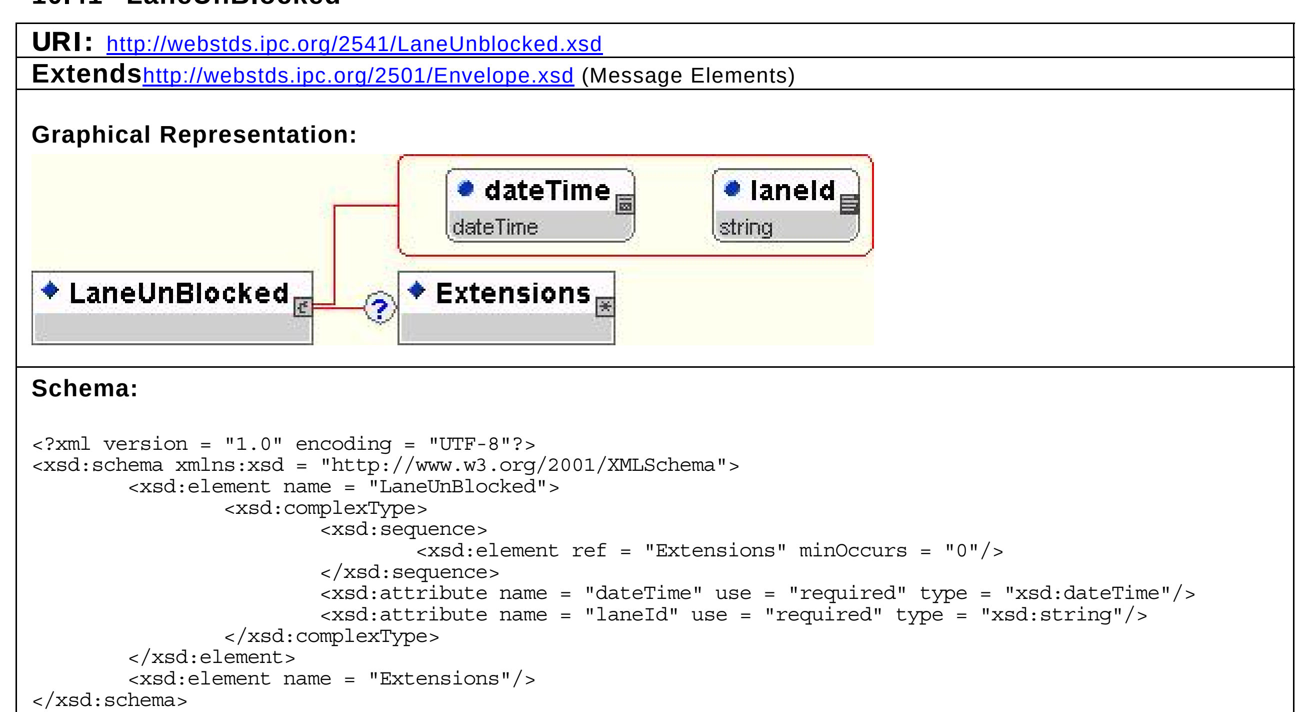
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "LaneStarved">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.41 LaneUnBlocked

URI: http://webstds.ipc.org/2541/LaneUnblocked.xsd

Extends http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

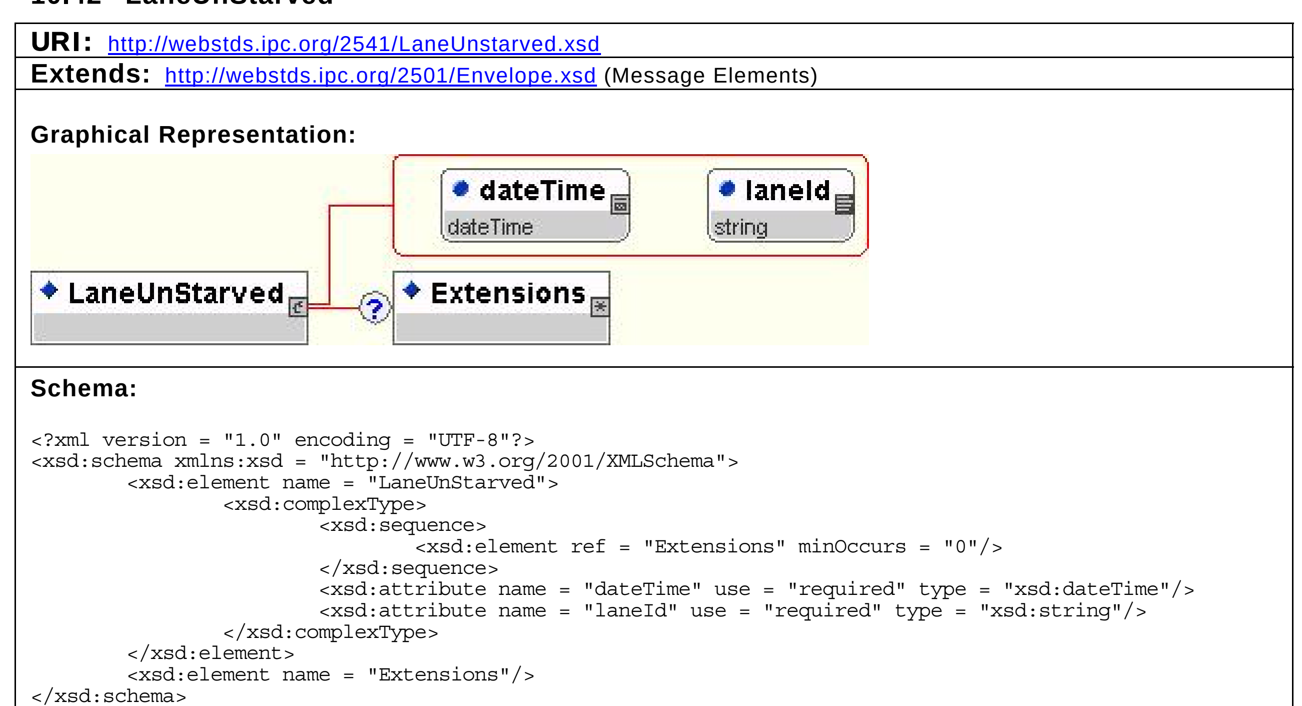
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "LaneUnBlocked">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.42 LaneUnStarved

URI: http://webstds.ipc.org/2541/LaneUnstarved.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

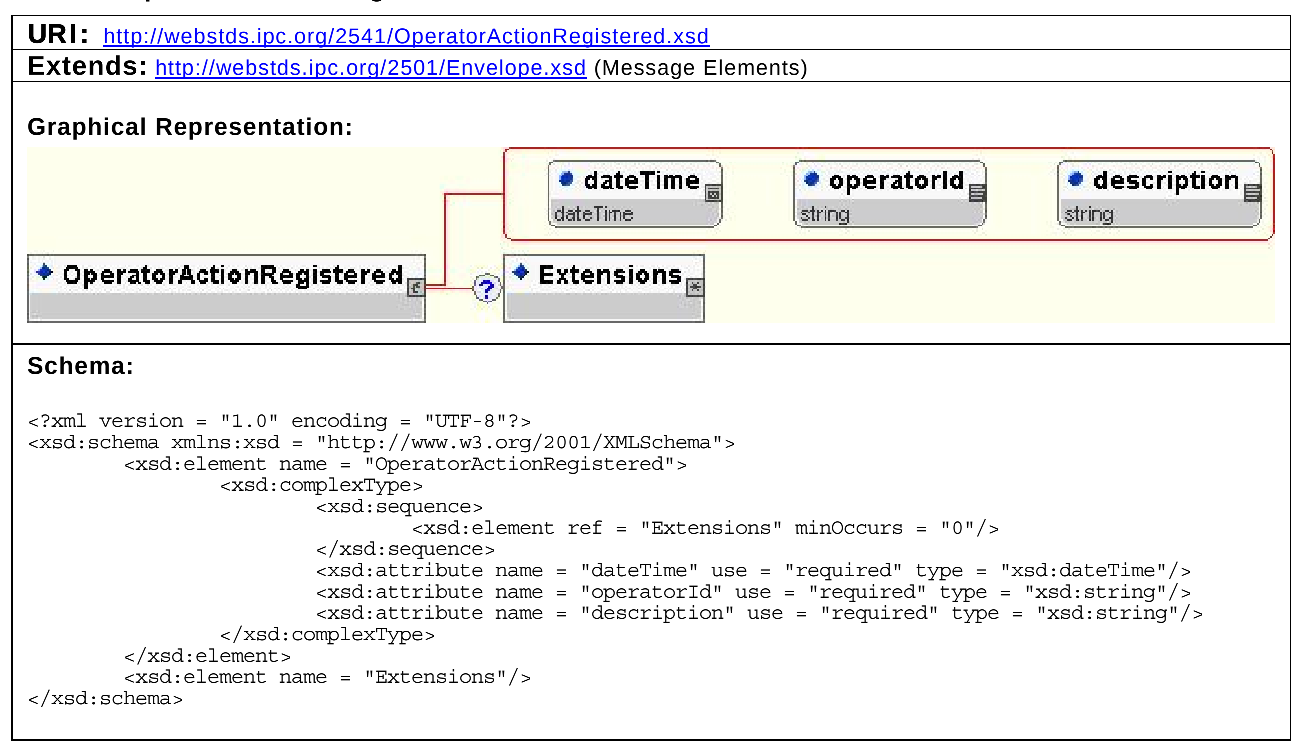
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
	<xsd:element name = "LaneUnStarved">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
			<xsd:attribute name = "laneId" use = "required" type = "xsd:string"/>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "Extensions"/>
</xsd:schema>
```

10.43 OperatorActionRegistered



URI: http://webstds.ipc.org/2541/OperatorActionRegistered.xsd

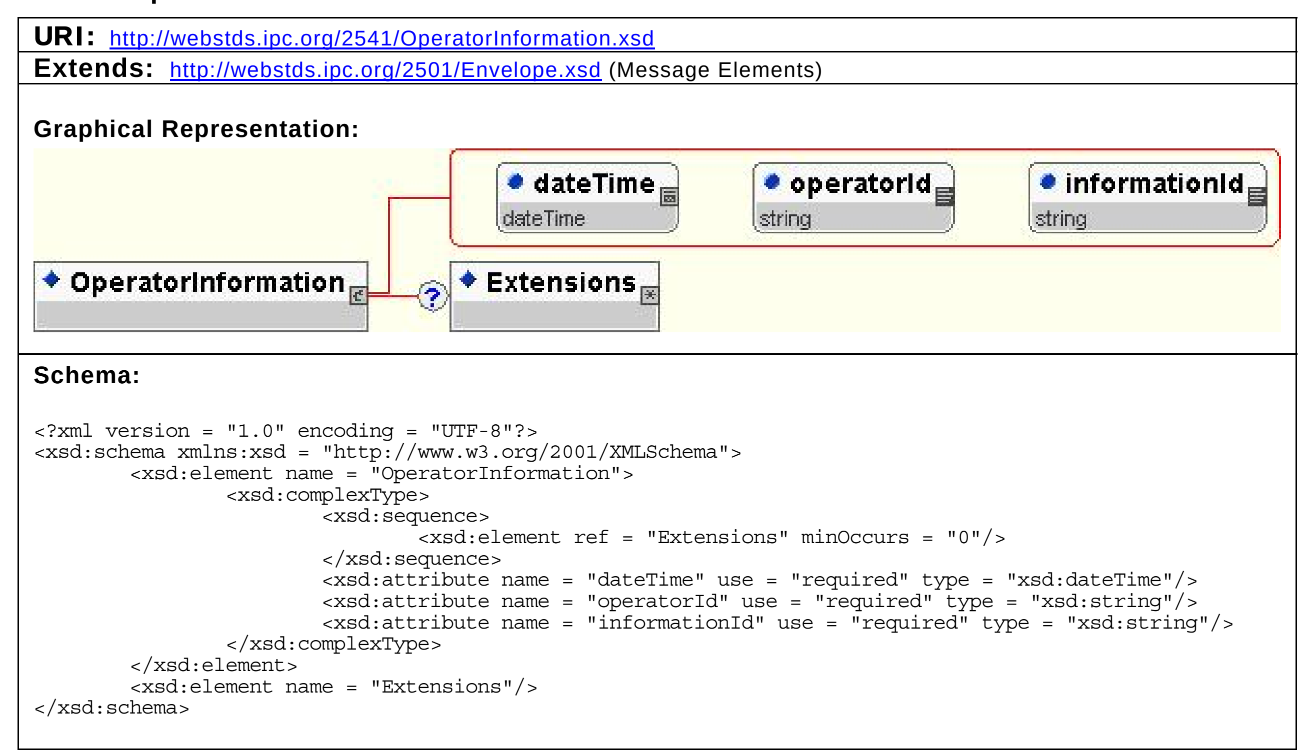
Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "OperatorActionRegistered">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "operatorId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "description" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.44 OperatorInformation



URI: http://webstds.ipc.org/2541/OperatorInformation.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:

Schema:

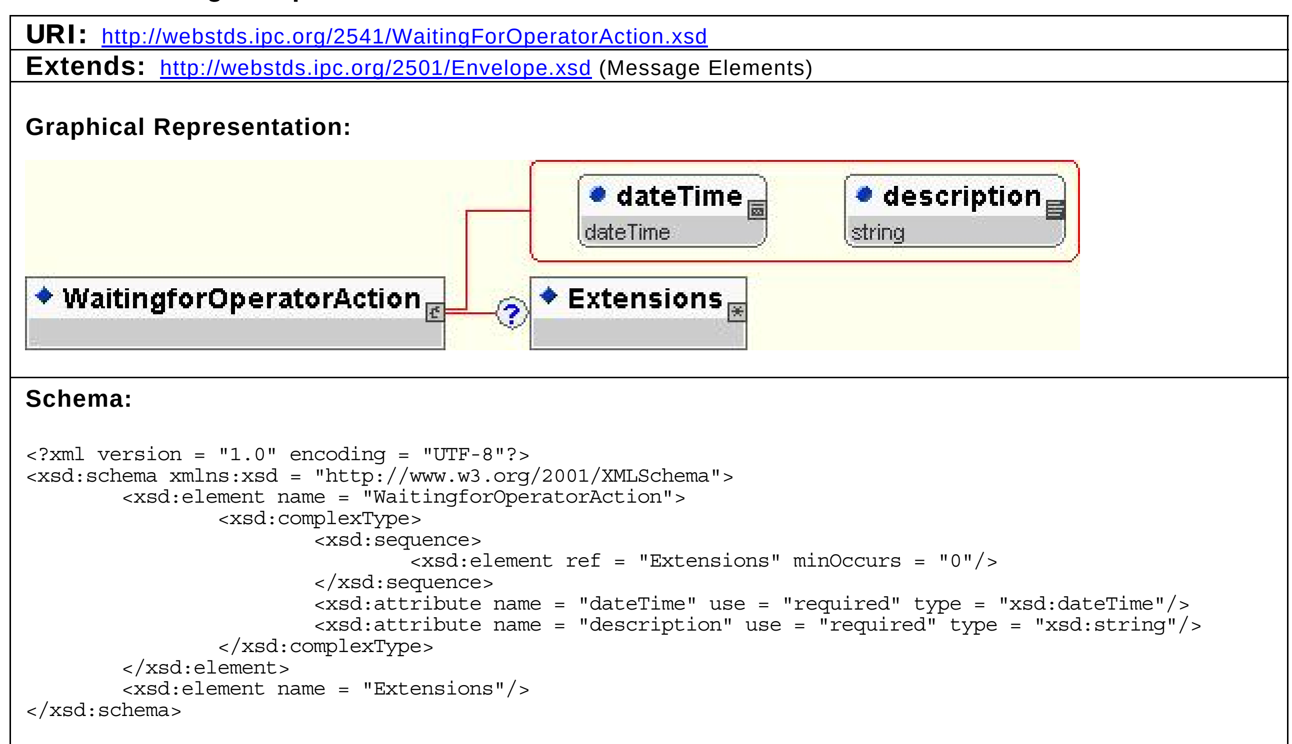
```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "OperatorInformation">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "operatorId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "informationId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

10.45 WaitingForOperatorAction

URI: http://webstds.ipc.org/2541/WaitingForOperatorAction.xsd

Extends: http://webstds.ipc.org/2501/Envelope.xsd (Message Elements)

Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema">
        <xsd:element name = "WaitingforOperatorAction">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "dateTime" use = "required" type = "xsd:dateTime"/>
                        <xsd:attribute name = "description" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

Appendix A – IPC Web-based Standards (IPC25XX)

The web-based standards (IPC 25XX) are designed to foster application integration and electronic commerce through data and information interchange standards based on XML. It assumes that application programs (including equipment interfaces) are distinct entities, and application integration takes place using a loosely coupled, message-passing approach. There is no need for a common object model, programming language, network protocol, persistent storage mechanism or operating system for two applications to exchange XML messages formatted using the web-based standards. The two applications simply need to be able to format, transmit, receive and consume a standardized XML message.

The web-based standards series have been identified for each of the value-added activities occurring throughout the product life cycle of an electronics product. The web-based standards are:

IPC-2500 – Framework Standard

IPC-2510 – Product Data Representation

IPC-2520 – Product Data Quality

IPC-2530 – Surface Mount Equipment Standard Recipe File Format

IPC-2540 – Shop Floor Equipment Communications

IPC-2550 – Manufacturing Execution Systems Communications

IPC-2560 – Enterprise Resource Planning Systems Communications

IPC-2570 – Supply Chain Communications

Table A-1 shows the correlation of the different standards in each of the series. Although not every standard has been started, the figure represents a coordinated opportunity to maintain consistency throughout the standard development cycle.

Table A-1 CAD/CAM Standardization

IPC Number/ Function	-xxx1 Generic	-xxx2 Administ	-xxx3 Documnt	-xxx4 Board Fabricat	-xxx5 Bare Bd Test	-xxx6 Assy Manufac	-xxx7 Assy/ Test/ Insp.	-xxx8 Comp. & Material	-xxx9 Informa. Modeling
IPC-2500 CAMX Framework	IPC-2501 PINS								
IPC-2510 GenCAM Product Data	IPC-2511A (Pub)	IPC-2512A (Pub)	IPC-2513A (Pub)	IPC-2514A (Pub)	IPC-2515A (Pub)	IPC-2516A (Pub)	IPC-2517A (Pub)	IPC-2518A (Pub)	IPC-2519A (Pub)
IPC-2520 Quality Product Data				IPC-2524 (Pub)					
IPC-2530 SRFF Process Data Recipe file	IPC-2531 ANSI Draft								
IPC-2540 Shop Floor Communicate	IPC-2541 2nd IF					IPC-2546 Interim final	IPC-2547 Interim final		
IPC-2550 Execution Communicate	IPC-2551 PINS			IPC-2554 Working draft		IPC-2556 PINS			
IPC-2560 Enterprise Communicate									
IPC-2570 Supply Chain Communicate	IPC-2571 Proposal					IPC-2576 Proposal	IPC-2577 Working draft	IPC-2678 Proposal	

Messages are the basis of the web-based standards. Messages are the means to integrate applications at the business-process level by defining a loosely coupled, request-based communication process. Since many business processes involve one party performing a service at the request of another party, the mapping of messages to requests is natural. An XML-based messaging system with open, extensible formats captures the essential elements of an electronics business communication message while allowing flexible implementations.

It is anticipated that in the vast majority of interchanges, the exchange of XML documents and messages between trading partners or applications will occur. Implementation using the CAMX Framework Standards will use a simple hyper-text transfer protocol (HTTP) transport, but business can also use other transports including file transfer protocol (FTP) and message queuing technologies.

Until applications have native support for XML, these types of CAMX Framework interchanges will require layered software that transforms native data types into XML.

The IPC 2541 and its sectional standards should provide value in both serialized and non-serialized production environments. In serialized production environments, detailed information from the production process can be gathered from each piece of IPC 2541 compliant equipment. In non-serialized production environments, it should still be possible to gauge overall production efficiency such as number of units produced in a given amount of time, or overall line and equipment status, by analyzing the IPC 2541 messages generated by each piece of IPC 2541 compliant equipment. If a bar code reader is present then a unique item identifier may be the bar code label that is read. If no bar code reader is present then the unique item identifier may be generated by the piece of equipment.